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THE POLICY OF CONSERVATION.

It is a pleasure to read so sane and level-headed a discussion of the conservation problem as that given by President Stillwell in his A. I. E. E. White Mountains address, an abstract of which appears elsewhere in this issue. The subject is one which has been talked about not unwisely but too well, until most people are somewhat irritated at a prolongation of the debate. This attitude is not because of lack of importance of the subject or lack of interest among the people in conservation of the country's resources, but rather because the discussion has merged into pettifoging quibbles and pot-house politics. The striking thing about Mr. Stillwell's consideration of the matter is that it treats the subject from a broad viewpoint and with a calm realization that conservation in its bigger sense is bound to come. Its importance to the future of the country is self-evident and the main question is, not whether natural resources shall be conserved, but how the thing may most effectively and justly be accomplished. The moot point of the effect of forest reservation and water-powers is taken up with a reasonableness which characterizes the address in general.

As our readers well know, there are at least three parties to this particular phase of the discussion. On the one hand there is a small group of enthusiasts, who go so far in their belief in the all-important bearing of forestation upon hydraulic conditions as to try to set some species of numerical relation by which the beneficent effect of forest preservation may be reckoned. This is not the unnatural point of view of some of those engaged in forestry work directly, and it is reflected in the present forest regulations, which Mr. Stillwell discusses. A second body, composed in part of political manipulators and in part of a noisy claque of promoters and their attorneys, take the stand that any relation between forestation and water flow is all bosh, and they have even succeeded in getting our unbalanced chief of the United States Weather Bureau to range himself ostensibly on their side, although if one examines his statements dispassionately they deal only with phases of meteorological science remote from the point at issue. The third party consists of those practical engineers who have by patient deductive methods investigated the effect of deforestation, not upon the absolute rainfall nor absolute run-off, but upon those costly and troublesome periods of high flood and extremely low flow, which are the bane of hydraulic development. These working hydraulic engineers of the country are practically uniting and agreeing that stripping the country of its forest covering has a serious effect on the steadiness of the run-off. No amount of forestation will render uniform the run-off of a year or of a season, but it is pretty well established that it does influence seriously the extent and number of those periods of unusual low water which bring worry to the managers of hydraulic enterprises.

Granting this, as President Stillwell unhesitatingly does, the question of most immediate importance is the relation of these facts to the policy of the Government in dealing with its water-powers. We would go even further than Mr. Stillwell and take the ground that the effect of forestation upon the unappropriated water-powers in the control of the Government is only

a side issue to the main question as to how and when the Government shall permit the utilization of these powers. They are part of the Government property held in trust for the people of the United States now and in the future, and the real issue that lies behind this whole conservation matter is whether the Government shall hold these powers in trust or whether it shall pass them over for a nominal consideration to a few hundred greedy citizens, to administer for their own private benefit only. In other words, the main issue is whether the Government shall promote and regulate the use of these, its assets, or give them over to the promoters. There is no use mincing words about this matter. It is an old story in governmental maladministration. Mr. Stillwell frankly takes the position that it is proper and right for the Government to conserve its resources and to permit their utilization only under cautious restrictions, and for this attitude he deserves the thanks of all good citizens who are interested in conservation. We quite agree with Mr. Stillwell that some of the present regulations can be improved. As he clearly shows, the water tax as at present laid out might become seriously burdensome in the very case where by low price of power the public is getting a specially large share in the benefits aside from the matter of tax. One must, however, admit that a tax on the hydraulic power utilized is by far the best safeguard to the public interest, since any tax levied on gross receipts for transmitted power could be practically evaded by the mere process of selling the output at wholesale to a dummy transmission or distribution company, a game which has already been played. It ought to be possible, however, to make a suitable tax on power generation with a system of rebates based on transmission distance, as in some of the Italian projects, and also on retail price at the points thus reached by transmission. The period of 50 years lease now proposed seems adequately long, but however the period may be adjusted, the lease should impose the carrying of a sinking fund for the equipment and the concurrent exploitation of all leases forming a physical system in the hands of the same organization, in order that leases should so expire that the Government, if deemed necessary, could recover all the rights pertaining to a particular lessee.

President Stillwell's alternative plan has many good points. He doubts somewhat at the start the wisdom of any plan which imposes a tax on water-power or fuel. This is at least an open question, but it should be borne in mind that the point of the conservation policy is, primarily, so to regulate the utilization of Government water-powers and fuel as to prevent their control to the detriment of the people at large, and only incidentally to levy rates upon them. The policy of conservation would be as effective by giving away the water rights and fuel with stern restrictions as to the price which should be charged therefor. President Stillwell's proposition looking to the equalization of royalties upon water-power and upon coal mine, these royalties to be used for the carrying out of the policy of conservation, strikes one as eminently sound. The second proposition, that the rental of water-powers should be based upon the amount of water-power and the effective head, is particularly sound, inasmuch as this is a correct measure of the value of the water for power purposes. Finally, he suggests that it might be well for the Government engineers to develop full preliminary plans for the working of the Government's hydraulic privileges as a preliminary to the awarding of suitable leases for the carrying out of these projects. This suggestion is a very valuable one, inasmuch as in prior discussions of this matter we have repeatedly called attention to the fact that the full value of conservation could only be attained by the deliberate coherent development of hydraulic privileges over wide areas. Such development would be greatly facilitated if it were thoroughly sketched out by the Government engineers prior to any attempt at exploitation.

THREE-PHASE CIRCUIT PROBLEMS.

Electrical engineers are so accustomed to operate three-phase circuits, and have such definite ideas, derived from experience, concerning the behavior of three-phase circuits, that they seldom realize how complex an arrangement an unbalanced three-phase system really is. The power-factor of a single-phase system is a fairly simple concept and experimentally determinable quantity. There is but little greater complexity in the definition or the determination of the power-factor in the case of a balanced three-phase system. But in the case of an unbalanced three-phase system, it is neither very simple to define, nor very simple to measure. Again, the relations of current and voltage in a closed delta-group of transformers, supplied from a three-phase system, are simple and definite. But if the delta is opened, so as to leave two sides only in operation, these relations become less simple.

Rules have been determined for solving both of the above problems. In the case of the unbalanced three-phase system at least two methods have been developed. Some interesting and apparently novel propositions appear on the subject, in this number, by Mr. R. K. McMaster. The four-reading, two-wattmeter method is certainly easily carried out, since it involves but a slight addition to the ordinary two-reading, two-wattmeter measurement. The precision of the measurement is, however, likely to be somewhat low, for the reason that it involves two differences between readings that may be relatively large, and of nearly the same magnitude. Moreover, the method seems to depend upon voltage balance between the three sides of the system. The article by Mr. R. G. Lafite, on page 1713, deals with the conditions of unbalance produced by opening one side of a delta three-phase load. It is shown that the two remaining sides of the delta carry their loads at a disadvantage, and with dissymmetrical regulation of pressure.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Elsewhere we print the first of a series of articles giving an account of the organization and work of the leading foreign national electrical engineering bodies of the world. It is appropriate that the Institution of Electrical Engineers of Great Britain should form the subject of the first article, as it antedates all others in organization, and has perhaps of all electrical societies most consistently maintained the character of a purely professional body. Though its membership is not confined to professional men, the management of the Institution rests almost entirely with this class, who in May, 1910, numbered 1173 in a total of 6222; for the Council, which includes all past-presidents and the chairmen of local sections and has a present membership of 47, can contain only three associate members or associates. Naturally the body has not maintained its professional character free of attack, and only recently has been subjected to strong influences from commercial and industrial sources which, if they should prevail, would greatly weaken this character. On the other hand, the Institution, in common with similar British professional bodies, has been the object of criticism on account of its non-professional and student grades of membership, and the organization is

advocated from time to time of a national professional body in which membership shall be eligible only to engineers of unquestioned standing and ability, and without reference to their field of work. As will be seen, the Institution has an enviable record of well-directed activity aside from the reading and discussion of papers, which doubtless is to be ascribed partly to its strong and stable government, and partly to the British repugnance to dilettantism, which term unfortunately applies to the work of many scientific and professional societies.

The governmental organization of the British and American national electrical engineering bodies differs, it will be seen, widely in many respects, and in several of these respects it would appear that this difference is greatly in favor of the British society. As conducted under its present system of government, the American Institute of Electrical Engineers is, in effect, a New York City institution, for its outlying branches have neither initiative nor voice in Institute affairs, and their status precludes any professional standing. As an illustration, it may be pointed out that while every paper presented at the New York meeting is printed in the *Transactions,* last year only five of 334 original papers presented at local sections and branches enjoyed that distinction. The British body, on the other hand, provides for full membership in its Council of the chairmen of local sections, who are elected by local nomination and ballot, and no discrimination appears to be made in favor of papers presented at the London meeting as against papers presented at local sections; in fact, in some issues of the I. E. S. *Transactions,* the papers and discussions from local sections largely predominate. In view especially of the commanding and time-honored position of London as the intellectual and professional center of the British Isles, the liberal treatment accorded to provincial groups of I. E. S. members is in striking contrast with the present A. I. E. E. oligarchical system.

While the manner of providing for the presidential succession in the British Institution is, under British conditions, more likely to assure the honor of the highest office to unquestioned leaders in the electrical engineering profession than would any system of popular nomination, the method, if adopted here, would undoubtedly fail owing to the facility with which it could be manipulated to serve individual and commercial ends. And it is at first sight singular that some of the abuses to which the British method would be here subject have attached themselves in no small measure to the radically different system of nomination of the American Institute of Electrical Engineers, particularly with respect to nomination of the president. To be entirely frank, the selection of the president of the A. I. E. E. has come to lie with one or more loyal friends of a prospective candidate, who, if they become active sufficiently early in the season, have merely to circulate a nominating paper for signatures which are rarely if ever refused, and in due course the official ballot of the Institute goes out with the name thus selected at the head. It may be said that other loyal friends may likewise bring forward the names of candidates, but after a circular has been put out in the interest of one candidate, very few men of presidential calibre will permit their names to be similarly exploited owing to the appearance that would be given of entrance into a contest for the nomination. With perhaps a couple of exceptions, those who in the past have received a nomination in this manner have been entirely worthy of the honor of election, but the more or less general knowledge of the origin of their candidacy has undoubtedly detracted from the estimation in which the highest officer of the Institute should be held by the membership and the public in general. Moreover, the underground methods inseparable from such a custom naturally gives rise to suspicion that ulterior motives may be behind a candidacy thus originated, thereby doing unwarranted injury both to the Institute and to the reputation of the officer-elect.

That such a custom of irresponsible nomination has taken strong root indicates some radical defects in the electrical system of the Institute, for its existence cannot be ascribed to any systematic effort to pervert to improper ends the present electoral machinery of that body. The fault, in fact, appears to lie in the necessary failure of any system of popular nomination where no open and systematic method is possible to bring before the electorate at large the qualifications of those who by character and ability are fitted for membership in their governing body, and where professional ethics forbid the personal seeking of office on the grounds of professional prominence or as the exponent of a cause on which Institute action may be desirable. Assuming this to be true, the remedy for a condition at present little creditable to a national professional body and one that in time may become intolerable, appears to lie in a method of nomination whereby candidates shall be chosen from the largest possible number of eligibles after due discussion, and put in nomination by a voice that speaks so far as possible for every geographical group of electors. The conditions may appear difficult of practical realization, but in point of fact the principles outlined form the basis of systems of nominations now in force in some societies, and their statement almost exactly describes the method of nomination of the Illuminating Engineering Society, which in practice has worked out almost ideally. According to the constitution of this society, which is organized on the basis of local sections of equal standing, each of which is represented in the Council by a vice-president, official nominations are made by a Board of Nominators, consisting of the two junior past-presidents and the vice-presidents whose terms expired at the two previous elections. The official nominations, which may be supplemented by other nominations by petition, are thus made by ex-officers who thoroughly appreciate the character of the men who should carry on the work of the society; and the Board is so constituted that each group of members has a voice in nominations, and no section can become dominant in the government of the body except by consent of one or more other sections. While this system could not be applied without change to the American Institute of Electrical Engineers owing to the present lack of provision for geographical representation on its Board of Directors, it could be adapted to the present organization of that body by the constitution of a nominating board consisting of one or more past-presidents and the chairmen of the various local sections. While this plan involves a large body with scattered membership, this would be the reverse of objectionable in principle, and in practice its operations could be conducted by a simple correspondence system centered at the Institute headquarters. Among the details might be provision for formal invitation to the membership to submit nominations by petition for the consideration of the board. However, any method that provides for responsible nominations in fact as well as in name, and which will be really national in its operation, would be an immense improvement over the present irresponsible custom of nomination; for the growth of this custom appears clearly to indicate a breakdown of the Institute's electoral machinery that calls for the most serious consideration.

Conservation of Water Powers.

President L. B. Stillwell of the American Institute of Electrical Engineers took as the subject of his presidential address, delivered on Tuesday at the White Mountain general meeting of that body, the conservation of water powers. The occasion, he said, seemed to be opportune for the presentation of a brief and non-technical discussion of the practical bearing and effect of existing laws governing the appropriation of water powers located on public lands which, he stated, as now construed and applied, are seriously retarding the utilization of these powers. The paper is somewhat similar in its treatment to one on the same subject recently presented by Mr. Stillwell at a joint engineering meeting in Boston.

The U. S. Geological Survey is quoted as authority for the estimate that the water powers of the United States at minimum flow aggregate 36,000,000 hp, or 67,000,000 hp on the basis of six months' flow per annum. A very large part of undeveloped water powers are either located on Government lands or are dependent, wholly or in part, upon the run-off from Government lands.

The relation of forest and stream flow is discussed at length and issue is taken with statements on the subject by Ex-Forester Pinchot and Dr. Willis L. Moore, Chief of the United States Weather Bureau. In summing up Mr. Stillwell states that he believes the following to be a correct statement of the controverted question: "While the aggregate annual run-off of our rivers in general depends upon the total annual precipitation, the presence of forest cover on the watershed regulates the rate of run-off to an extent which in many cases materially affects the value of the water power, this regulation tending to equalize the flow and prolong it during the dry season." The paper then proceeds to discuss at length certain provisions included in the present regulation of the Forest Service governing the appropriation of water powers depending in whole or in part upon forest reserves. This discussion includes a consideration of imposed rates as a tax on power enterprises, which contains suggestions as to features of the present measures of regulation which should be changed.

In summing up Mr. Stillwell states that while one who criticises adversely a plan which had been elaborated by others is not necessarily under obligation to suggest an alternative plan; and that while any plan which imposes a tax upon water power or fuel is at best of doubtful wisdom, he did not consider it improper to suggest the outline of a plan which, from the standpoint of public policy, appears, in his opinion, preferable to that now in force. The full text of the alternative plan proposed is given below:

(1) A tax imposed on all sources of power found upon public lands—a royalty on coal mined and a rental upon water power. The charge for water power to be based not upon an indefinite and disputed relation of forest covering and commercial value of the power, but upon the fact that the Government needs revenue to develop and conserve our natural resources, owns the power, and, as owner, possesses an unquestionable right to impose a charge for its use. The Federal Government is now selling coal lands on the public domain at prices which, on the average, approximate one-tenth of 1 cent per ton of the coal which it is estimated the property can commercially yield. If the coal be used to produce power under average conditions this tax is substantially equivalent to 5 cents per 1000 kw-hours as against an average rental of 20.86 cents per 1000 kw-hours now imposed in the case of water power. The theory of conservation unquestionably points to an increase in the price fixed for coal lands or a decrease in water power rental, or both. By adjusting the charges for coal and water power to approximate equality, as measured by their respective ability to produce power, the tendency of the present method to stimulate the use of coal for power purposes as against the use of water power—a tendency in direct contravention of the fundamental idea of conservation—will be avoided and the aggregate revenue ultimately available to the Federal Government for the purpose contemplated will be enormously increased.

The general features of the present contract agreement enforced by the Forest Service as regards 50-year limit of the period of appropriation should be preserved. The other restrictions now imposed should also be retained except that certain clauses should be modified to meet the practical objections which have been pointed out, in so far as mature consideration may determine the validity of those objections.

The proceeds of royalties upon the sale of coal lands and forest products and rentals of water powers to be used to conserve our national resources by development under broad and systematic plans—to conserve forests, build dams, improve navigation and irrigate the arid lands.

(2) The charge imposed upon water powers to be based upon the amount of water appropriated and the effective head resulting from the topography of the Government lands concerned.

Under the present plan, it is necessary to measure the water used in order to fix the third deduction from the charge based upon output. The difficulty of measuring water, therefore, must be met and it is as easy to fix the second feet appropriated as to fix the deduction allowed for artificial storage by a permittee.

Under this plan it would be to the interest of the permittee to install a plant of high efficiency and not a plant of low efficiency as the present method of charging suggests. An important practical point in this connection is the fact that the estimate of competent Government engineers, discussed with and agreed by the permittee, would constitute a safer basis for the investor who may undertake to finance the enterprise than he now has in the data submitted for his consideration by the promoter.

(3.) There is a third suggestion which perhaps may be worthy of consideration in view of the fact that conditions as regards cost of development and characteristics of the market for power differ so widely in various parts of the country. That suggestion is that the Government engineers of the department or bureaus concerned develop comprehensive preliminary plans for the development of water powers of a given watershed and that these water powers collectively or severally be leased to the highest bidder, the Government, of course, reserving the right to reject all bids.

Electrification of Railroads.

Mr. George Westinghouse, president of the American Society of Mechanical Engineers, will present at a joint meeting in London, July 28, of the American Society of Mechanical Engineers and the British Institution of Mechanical Engineers, a paper entitled the "Electrification of Railways," in which the imperative need is pointed out for the selection of a system of electric traction for universal use in transforming steam railroads. From advance issues of the paper the following abstract has been prepared:

The great difficulty with the electrification of standard railroads is not, he states, any longer an engineering problem of developing a locomotive and an electrical system which will operate trains, but is a broad question of financial and general policy of far-reaching scope, considering the future electrification of railways in general as distinguished from isolated cases of limited extent. He directs special attention to one phase of this question and earnestly urges the necessity for a very early selection of a comprehensive electrical system embracing fundamental standards of construction, for such a standard must be accepted by all railway companies in order to insure a continuance of that interchange of traffic which, through force of circumstances, has become practically universal.

He says the present tendency in electrification seems to be toward diversity rather than unity, and calls attention to the intolerable situation that existed in this country at one time owing to non-standardization in railroad practice. In 1878 there were in the United States 11 different gages of railroad tracks, and the losses subsequently entailed in the change of gage and equipment have ever since been serious burdens to

most of the railways concerned, as the cost in most cases was covered by capital charges.

The paper lays down the following requirements for interchange of traffic, the last three relating specifically to electrically operated railroads: Standard gage of track; standard or interchangeable type of coupling for vehicles; uniform interchangeable type of brake apparatus; interchangeable heating apparatus; uniform system of train signals; supply of electrical energy of uniform voltage and frequency; train supply conductors so uniformly arranged with reference to the rails that an electrically fitted locomotive or car of any company can collect its supply of current when upon the line of other companies; uniform apparatus for the control of electric supply, whereby two or more electrically fitted locomotives or cars from different lines can be operated together from one locomotive or car.

The paper then proceeds to give an account of the development of alternating-current apparatus, which is followed by a discussion of the several present systems for electrical railways, namely: The direct-current or third-rail system; three-phase system with two overhead trolley wires and the single-phase, high-tension system with single overhead trolley wire. A summary of the discussion is given as follows:

Locomotives equipped with each of the three types of motors have been in successful operation, and have demonstrated their usefulness, capacity and reliability in practical railway service. The three-phase motor having a definite constant-speed characteristic is particularly adapted to certain conditions, but on the other hand it has less general adaptability to the ordinary varying conditions of railway operation. The single-phase motor has a facility of voltage control which gives an efficient means of speed adjustment, and in this particular is superior to the other systems. As to locomotive costs, the differences are in many cases more than offset by the cost of other elements in the electrical system.

The conditions between the methods of transmitting are, however, said to be of far greater importance than differences between power houses or between locomotives. The transmission systems for direct-current, three-phase and single-phase systems are then contrasted on the basis of the number of links or elements between the power house and the electric motor.

For the direct-current system these links consist of raising transformers in groups of three; a transmission line of three wires together with substations which require attendants; substation transformers in groups of three; rotary converters for converting to direct current; third-rail contact conductor, which for heavy work must often be supplemented by copper feeders; a track return circuit which must be provided with heavy bonds and in certain cases supplemented by feeders and so-called negative boosters. Moreover, it is necessary to maintain the alignment of the third-rail within close limits, both in its distance from the track rails and its elevation above them, as the contact shoe can have only a small range of automatic adjustment.

For the three-phase system the respective links between the generator and the locomotives are as follows: Raising transformers in groups of three; transmission line of three wires; substation transformers in groups of three; two overhead wires as a contact system; a track return which usually requires nothing but inexpensive bonding. The overhead trolley wires require a double system of overhead construction, as the wires must be kept separated and well insulated from one another. They must be maintained at equal height above the track and at switches and cross-overs, as the construction is complicated.

For the single-phase system the corresponding links are as follows: Raising transformers; a transmission line of two wires and substations widely spaced; a substation lowering transformer; a single trolley wire; a track return usually requiring only inexpensive bonding. In certain cases where the distance from the power station is not more than 15 or 20 miles, a single-phase trolley can be supplied directly from the power house, so that only one single element, namely, the trolley wire, intervenes between the generators and the locomotives. The single trolley wire permits a relatively wide range and height, as the pantagraph trolley automatically adjusts itself to the position of the trolley wire. In some cases the wire has a normal height of 22 ft. and may be carried under bridges where the limit is 15 ft.

As to the requisites for a universal electric system, the following elements are noted as of prime importance:

The electric locomotive should be capable of performing the same kinds of service which the steam locomotives now perform. This will be most readily secured by electric locomotives which can practically duplicate the steam locomotives in speed and power characteristics. This includes a wide range of performance, embracing through passenger service at different schedule speeds; local passenger service; through freight service in heavy trains; the handling of local freight by short trains; and a variety of switching, terminal and transfer movements. This naturally calls for wide variation in tractive effort and in speed, both for the operation of different kinds of trains, and also for the operation of the same train under the varying conditions usually incident to railway service.

The electric locomotive should be capable of exceeding the steam locomotive in its power capacity. It should be able to handle heavier trains and loads, to operate at higher speeds, and in general to exceed the ordinary limits of the steam locomotive in these regards. The readiness with which several electric locomotives can be operated as a single unit enables any amount of power to be applied to a train.

The electric system should adapt itself to requirements beyond the ordinary limitations of the steam locomotive in small as well as large things. It should be adapted for use on branch lines, and for light passenger and freight service similar to that so profitably conducted by interurban electric roads, which in many cases run parallel to steam roads, not only taking away the traffic of the steam roads, but building up a new and highly profitable traffic, both in passenger and in express service.

A universal electrical system requires that power should be transmitted economically over long distances and supplied to the contact conductor. The system should utilize the most highly perfected apparatus for the electric transmission of energy and its transformation into suitable pressures for use.

The contact conductor in an ideal system should be economical to construct, both for the heaviest locomotives where the traffic is dense, and for light service on branch lines. It should impose minimum inconvenience to track maintenance; should give minimum probability of disarrangement in case of derailment, or in case of snow and sleet, and should in general be so placed and constructed as to give a maximum assurance of continuity of service.

The paper points out that the use now made of electricity in steam railway service has been brought about, generally speaking, through compulsion. The steam locomotive has reached its limitations and has been found unsuitable and inadequate in tunnels or in terminal service. Even where other considerations may have been controlling, the problem has usually been a specific one of electrifying a relatively small area. The problem has been solved by considering those factors which were of immediate importance, without giving weight to uniformity with other systems or of extension.

The natural course of development will be the extension of these limited zones, until after a time they meet. Then there will arise great inconveniences and expense if the systems are unlike. For the present it may be a matter of little moment whether different systems have their contact conductors in the same position, or whether the character of the current used is the same or different. In the early days of railroading, it was of little consequence whether the tracks of the different systems in various parts of the country were alike or unlike, but later it did make a vital difference, and the variation resulted in financial burdens which even yet lie heavily on some railways. It is this large view into the future of electrical service which should be taken by those responsible for electric railway development.

The complete electrification of a railway will necessitate a rearrangement of ideas and practices in regard to operations. Coaling and watering places will not be needed; passenger trains will be differently composed, some classes being of less weight; and they will operate more frequently, thus promoting travel; other trains will be heavier than at present, or will operate at higher speeds; and branch lines, by the use of electrically fitted cars, can be given a through service not now enjoyed.

The movement of freight will undergo great changes, due to the fact that electric locomotives can be constructed with great excess capacity, enabling them to move longer trains at schedule speed on rising gradients. The large percentage of shunting operations due entirely to the use of steam locomotives will no longer be required.

The railway companies can combine upon some co-operative plan for the generation of electricity, thereby effecting large savings in capital expenditures; and can utilize their own rights of way for the transmission of the current, not only for the operation of trains, but for many other useful purposes. By cheapening the cost of generating electricity through the development of gas and oil engine power, a still further reduction in cost will accelerate the work of electrifying existing railways.

Mr. Westinghouse points out that there will be serious difficulties to surmount in the selection of a general system. There naturally will be arguments in favor of one or another of the systems now in use and the inclination of those who have adopted a particular system to advocate its general use. There will be enthusiastic inventors, and there will be many advocates of the common view, namely, that there is room for several systems and that each system will best meet the requirements of a particular case. There will be those who give undue weight to some feature of minor importance, such as a particular type of motor or of locomotive, instead of giving a broad consideration to the whole system, and recognizing that, in the general problem of railway electrification, facility and economy in transmitting power from the power house to the locomotive, are of controlling importance. Were there now only one system to be considered, there would be a concentration of the energy of thousands on the perfecting and simplifying of the apparatus for that system, to the advantage of railway companies and of manufacturers.

In conclusion Mr. Westinghouse earnestly recommended to the serious consideration of railway engineers and those in authority, the pressing need of determining the system which admits of the largest extension of railway electrification and of a prompt selection of those standards of electrification which will render possible a complete interchange of traffic in order to save expense in the future and to avoid difficulties and delays certain to arise unless some common understanding is arrived at very shortly.

International Electrotechnical Commission.

The first annual report, dated Dec. 31, 1909, of the International Electrotechnical Commission has been issued, and contains an account of the work of that body since its organization in 1906. The text is in both English and French on opposite pages, and a frontispiece portrait of Col. R. E. B. Crompton is included. In the preface, which is by Prof. Elihu Thomson, president of the commission, it is stated that the commission is in a large measure due to the efforts of Colonel Crompton, who read an important paper at the St. Louis congress, which aroused general interest in the subject. A deserved tribute is also paid by Professor Thomson to Mr. Le Maistre, the general secretary, of whose work and success in securing the formation and active interest of the committees in various countries the report is stated to be sufficient evidence. The annual report also refers in complimentary terms to Mr. C. O. Mailloux, to whom the commission is stated to owe a debt of gratitude for services at the preliminary meeting and at the first council meeting, where his linguistic powers helped greatly to smooth away the many little difficulties and misunderstandings inseparable from a large international meeting.

The report states that the British, Danish and French committees have appointed subcommittees on the subject of electrical nomenclature, which have collected a large number of terms the explanations of which have been agreed upon. The various electrotechnical committees have been requested to concentrate their efforts toward the attainment of international conformity on the general manner of expressing Ohm's law. The question of standards for electrical machinery will shortly be brought before the commission in a more or less concrete form. An informal meeting of the commission will be held this summer in Brussels, at which ratings of electrical machiery will be discussed. The next regular meeting of the commission will be held in Berlin in 1911.

At present the following countries are represented in the commission: Belgium, Brazil, Canada, Denmark, France, Germany, Great Britain, Hungary, Italy, Mexico, Spain, Sweden and the United States. Austria, Holland, Japan and Russia have declared their adherence, and steps are being taken for the formation of committees in Roumania, South Africa, Uruguay, Chili and the Argentine Republic.

The work of the committee appears to be best organized in Great Britain, Denmark and France. In Denmark there are subcommittees on nomenclature, international light unit and electrical machinery; in France on nomenclature and electrical machinery, and in England on nomenclature, symbols and international unit of light.

Electrical Shows.

The present vogue of electrical shows, while undoubtedly beneficial to the central-station branch of the electrical industry, has thrown a heavy burden on manufacturers who contribute to the success of such affairs by exhibits of their products. If the expense were reasonable, few manufacturers would object to exhibiting at shows where the underlying motive is to promote the industry; but a strong feeling has gradually been growing among electrical manufacturers against taking part in exhibitions held merely for the benefit of promoters, who for the time being have gone into the show business as a money-making proposition. This feeing has been recognized recently in making plans for shows whereby these are co-operative in principle, the exhibitors sharing in the profits of the undertaking. The St. Louis electrical show just closed is an illustration of how an exhibition can be conducted for the purpose of furthering the development of the central-station industry without entailing heavy expenses on the exhibitors. At the St. Louis show exhibitors were charged approximately 85 cents per square foot for space, this amount including lighting, etc., and at the end of the show no less than 60 per cent of this charge was refunded. The income from space rentals was $8,780; from box office, $2,497, and from trade tickets, $1,024.25, making a total of $12,301.25. The total of disbursements was $7,033.25, leaving a profit of $5,266, which was distributed pro rata among the exhibitors, thereby reducing their actual expenses at the show from 85 cents to about 34 cents per square foot of space occupied.

Starting Device for Squirrel-Cage Rotor.

It is proposed in a patent issued to Mr. S. R. Bergman to improve the starting torque of a squirrel-cage induction motor by providing two end-rings in parallel, one of low and the other of relatively high resistance. A laminated iron ring mounted on the rotor shaft is so arranged that it can be shifted to or from the low-resistance end-ring and in this way vary the reactance of this circuit. When starting, the reactance of the low-resistance circuit is a maximum, and more current will be carried by the high-resistance ring than by the low-resistance ring. Thus reducing the total current and increasing the torque.

Convention of Brooklyn Company Section of the N. E. L. A.

The second annual convention of the Brooklyn Company Section of the National Electric Light Association took place on June 24 at the Oriental Hotel, Manhattan Beach, N. Y. Over 400 members and guests were in attendance, among the latter being representatives of Company Sections and visitors from various parts of the country.

The reports of the officers and committees showed exceedingly satisfactory progress for the year. After the initial preliminaries Mr. Paul Lupke's paper on "Super Specialization" was read by Mr. E. W. Babcock, and it aroused much interesting discussion. Another St. Louis paper, "The Workings of a Collection Bureau," by Mr. J. C. Vanduyne, was read by Mr. F. J. McCormack and was freely discussed. An original paper on "Electric Power Plant Operation" was then read in three parts, "Steam Operation" by Mr. C. H. Courser, "25-Cycle, High-Tension System" by Mr. J. F. Chute and "Substations and Low-Tension Distribution" by Mr. H. B. Pope. Mr. M. S. Seelman, Jr., then read Mr. T. I. Jones's St. Louis paper on "The Organization and Functions of a Sales Department." All these papers were freely discussed by members of the Company Section and visitors.

Intermission followed, after which dinner was served and the program resumed at 8 o'clock. Mr. J. J. Leddy read the report of the committee on "Overhead Line Construction," which was followed by an address by Mr. C. F. Scott, who dwelt upon the changes wrought in the lives and habits of people of the world by the application of electricity. Mr. R. D. Rubright read his paper on "Job or Work Order System" and Mr. L. C. Chatfield presented Mr. Randall's paper on "High-Tension Transformers."

Mr. W. W. Freeman, general manager of the Brooklyn Edison Company, then addressed the gathering, congratulating the men on the success achieved and expressing his belief in the educational value of the institution. He also touched lightly on plans which the Edison Electric Illuminating Company of Brooklyn had in mind, but had not yet formulated, dealing with the question of old age pensions for employees and with a plan of profit sharing in which employees would participate. The following officers were elected: Mr. E. A. Baily, chairman; Mr. F. J. McCormack, vice-chairman; Mr. B. C. White, secretary; Mr. F. C. Hill, treasurer, and Messrs. E. A. Baily, G. L. Knight, J. W. Lafferty, E. W. Babcock, J. D. Campbell, T. W. Buxton, R. D. Rubright, T. I. Jones, H. P. Wood, W. W. Bennett, F. W. Morris and Messrs. W. W. Freeman and W. F. Wells, ex-officio, executive committee.

Illuminating Engineering Society Chicago Meeting and Election.

The Chicago Section of the Illuminating Engineering Society held the last meeting of the season, June 21, in the new restaurant in Lincoln Park, and the topic of the evening was a specific discussion of the lighting of that building, which has been recently completed. Before the discussion the following section officers were elected for the ensuing year: Chairman, Mr. Frederick J. Pearson, electrical engineer for Marshall Field & Company; secretary, Mr. William E. Keily, associate editor *Electrical World;* managers, Messrs. J. G. Learned, contract agent North Shore Electric Company, and C. A. Luther, illuminating engineer of the People's Gas Light & Coke Company.

The meeting then took up a discussion of the lighting arrangements of the room in which the dinner was held. This room is 48 ft. x 84 ft., finished in tan brick and ornamental tile. The roof slopes from a small central skylight and the steel roof arches are exposed. The method of lighting selected by the architect was to hang from a center line two large elongated sphere art-glass fixtures with tungsten lamps inside, and with a few carbon lamps studded around the outside. Each chandelier requires 2400 watts. Around the walls 1500 watts are required in brackets equipped with roughed glass balls and 25-watt tungsten lamps. The total watts are about 3900 for a floor area of about 4000 sq. ft. The architectural effect was very pleasing, but the illumination in the central part of the room was insufficient, due partly to the absence of any method of directing the light downward from the art-glass fixtures, and partly to the blinding effect of the large number of bracket lamps around the walls.

Mr. T. R. Beebe, commenting on the plan, suggested that a better arrangement would have been to place art-glass boxes at the tops of each of the wall columns, instead of using low wall brackets. This would be more in keeping with the architecture than the present wall brackets and would place the wall lamps out of the line of vision.

Mr. J. R. Cravath suggested two plans: One that of placing art-glass boxes with the proper reflectors inside high up on the steel work near the roof. With such an equipment the whole room could be covered without the necessity for bracket lamps, although, if desired, art-glass boxes high on the wall columns could be used. Another plan he suggested was to use a false skylight and place lamps between the real skylight and the false skylight. He also suggested that by the use of reflectors on the lamps inside of the present art-glass fixtures, a much larger percentage of light could be delivered down in parts of the room where it is needed. The wall and ceiling loss is now excessive.

Mr. Hamilton, the architect of the building, objected to the use of reflectors inside of spherical art-glass fixtures on the ground that they might cast shadows on the glass, but it was pointed out that this could be overcome by the use of translucent reflectors, such as prismatic or opal, and that all reflectors could be placed so that their lower edges would come opposite the horizontal band around the middle of the fixture. Mr. Hamilton said that he might have studded the steel arches with lamps and have made this interior look like a coliseum or the White City, however, something more dignified was wanted. He called special attention to the design of concrete posts in the surrounding park, which have attracted wide attention. The concrete posts on the porches surrounding this restaurant have the electric conduit embedded in the concrete when it is poured.

Licensing of Professional Engineers.

With an attendance, including ladies, of about 500, the forty-second annual convention of the American Society of Civil Engineers in Chicago, on June 20-24, was devoted largely to the visiting of engineering points of interest and to entertainment features. There was, however, one business meeting and three evening lectures. Only a few subjects of direct electrical interest were taken up. The sessions of the convention were held in the Congress Hotel, and the first feature was an informal reception on Monday evening, June 20. The principal business session was held on Tuesday forenoon. The visitors were welcomed to the city by Dr. W. A. Evans, commissioner of health, who appeared as the representative of Mayor Busse. Dr. Evans made an excellent speech, in which he pointed out how engineers and physicians are working toward one end—the greater comfort and happiness of mankind.

Mr. John A. Bensel, of New York, president of the society, in his presidential address, emphasized the declaration that there are only two classes of engineers—civil and military. Referring to such titles as mechanical engineer, mining engineer, electrical engineer, etc., he said: "The schools, in their general mix-up of titles, certainly befog the public mind, the same as if in medicine at graduation there were degrees granted for brain doctors, stomach, eye and ear, etc." A considerable portion of the address was devoted to the engineer's place in influencing public affairs. Mr. Bensel spoke of possible legislation affecting the standing of engineers, and, alluding to the

trend of events in general, said that, "Our whole scheme of government seems to be passing from a representative form, on which it was founded, to some new form as yet undetermined." Men who by education and training are best fitted to consider facts and not desires should try to guide society as much as possible along its new lines.

A short report was presented from the committee on the licensing of civil engineers, of which Mr. Bensel is chairman. This report summarized the laws in effect in Canada, Mexico and the states of Wyoming, Louisiana and Florida. There are also statutes governing the practice of land surveyors in the states of Idaho and South Dakota. The subject of licensing engineers has been agitated also in the states of New York, Ohio, Pennsylvania, South Carolina and Washington. The committee believes that there is an unmistakable tendency toward legislation regulating the practice of civil engineers, and that it is important that there should be uniformity in this respect in all states. The committee argues also that the statute enacted by any state on this subject should define the term "civil engineer," and electrical men will be interested in the definition which the committee recommends. This definition reads as follows:

"A civil engineer, within the meaning of this act, is one who practices any branch of the profession of engineering other than military. Said profession embraces the design and construction of public or private utilities, such as railroads, bridges, highways, roads, canals, harbors, river improvements, lighthouses, irrigation works, water supplies, sanitary systems, and the development, transmission, and application of power, and includes all industrial, hydraulic, municipal, structural, electrical, mechanical, mining and other works which require experience and the same technical knowledge as engineering schools of recognized reputation prescribe for graduation."

The committee further recommends that all such statutes should prescribe that a practitioner of civil engineering should be not less than 25 years of age, of good moral character, and have been engaged actively in civil engineering as an assistant for at least six years, and in responsible charge of engineering work for at least one year. For a graduate from a recognized school of engineering the term of actual engagement as an assistant should be four years. These are the minimum requirements for corporate membership in the American Society of Civil Engineers, and the committee holds that there should also be inserted in any law a clause to the effect that the certificate of corporate membership in that society should entitle its holder to practice as a civil engineer without examination. The committee also recommends that the fee for the issuing of a certificate shall not exceed the sum of $25. It is also proposed that it shall be unlawful for anyone unlicensed to accept engagement as a civil engineer, and that no unlicensed person shall be allowed to sue for compensation for services rendered, or to qualify as an expert witness before any state or municipal court. Methods of conducting examinations for admission to practice are suggested.

In the discussion, some of the more broad-minded members brought up the question of the recognition of other national engineering societies in the proposed licensing laws. To this objection the president replied pointedly that the doors of the American Society of Civil Engineers are open to all engaged in the practice of civil engineering. As indicated in the president's address, all engineers who are not military engineers are defined as civil engineers. The report on licensing was referred to the board of direction, with power to act on behalf of the society.

Subaqueous Signaling.

An interesting talk on submarine signaling was given before the Colorado Electric Club at its lunch on June 23, by Prof. Lucien I. Blake, in which the unreliability of air was contrasted with the reliability of water or solids as mediums for sound waves. He described the variation in distances in sunshine and darkness at which sounds of equal density can be heard, explaining about "zones of silence," "picking up sounds along the water," etc. None of these variations he stated effect submarine signaling. The whole difficulty was to obtain the proper transmitter making audible and clear the vibrations under water and then to develop the water microphone, which was really the easier part of the problem. The equipment of lightships, transatlantic steamers, etc., with signaling and receiving devices has made travel almost infinitely safer in fogs and storms than before. The signals are reliable at 15 miles, which is outside of the necessary distance. Both direction and distance can be determined from the character of the sound and its intensity, and the number of strokes indicate the point on the international map. While considerably more restricted in its zone than wireless telegraphy, he considered that subaqueous signaling is at present in a much more perfected state and applied to a much more generally useful field.

British Decision on Valuation of a Public Service Property.

On an appeal from the Supreme Court of New Zealand the Judicial Committee of the Privy Council of England has made an important decision as to the value of a "Gas Works and Plant."

In 1895 an act of the New Zealand Legislature authorized the Hamilton Gas Company to construct works in the city of that name on condition that the city might purchase the "gas works and plant" after 12 years at a price to be determined by arbitration.

The city decided to purchase the works, and as the arbitrators could not agree on the valuation an umpire was appointed. The umpire found that the value of the gas works and plant considered merely as a structure was about $65,000, but that the commercial value of the works—that is, the value of the plant and business combined, was about $150,000, and a case was stated for the Supreme Court of New Zealand as to which basis of valuation should be adopted.

According to this case the matter turned on the meaning of the words "gas works and plant" used in the statute. The Supreme Court of New Zealand having found that these words meant only the physical structure of the plant in position, the company appealed to the Privy Council.

Lord Shaw delivered the judgment of the Privy Council and supported in substance the contention of the gas company as follows, according to the statement of the special case:

"At the hearing, the gas company contended that the price to be paid for the purchase of the gas works and plant should be the commercial value thereof as a going concern, taking into consideration their present condition, rental value, earning power, and all surrounding circumstances, and not merely as on a sale of apparatus in situ and land and buildings; and that the arbitrators and umpire, in arriving at and determining such price, were entitled to capitalize the net annual profit or rental which, in their opinion, the gas company was, and might reasonably be expected to be, able and continue to earn and receive thereby and therefrom."

Opposed to this position of the gas company the contention was thus stated:

"The Borough Council claimed that the price should be merely the value of the gas works and plant regarded as gas works and plant in situ capable of earning a profit, and that this value should be arrived at by taking the present value of the land and buildings and adding thereto what would be the present cost of the machinery and materials of a similar gas works and plant and of placing such gas works and plant in situ and making good the ground and deducting a sum for depreciation; or by taking the cost of the land, buildings, gas works and plant, and laying down the gas works and plant, making good the ground, and deducting a sum for depreciation."

According to the judgment delivered by Lord Shaw the above contention of the gas company was correct and the company was entitled to the value of $150,000 found by the umpire for

its plant as a going concern, instead of the value or cost of the plant merely as a structure at $65,000. It is to be noted that the value thus awarded for the "gas works and plant" under the statute was 2.3 times as great as the mere structural value or cost of the works less depreciation, and that this higher value was obtained by capitalizing the annual net profits that the company was and might be expected to continue to earn.

Hydroelectric Energy for New Chicago City Hall.

On the recommendation of its committee on city hall and public buildings, the City Council of Chicago has directed the commissioner of public works to accept the bid of the Sanitary District of Chicago for electric lighting and power service in the new city hall. The price to be paid is 1¼ cents per kw-hour, and a minimum consumption of not less than 600,000 kw-hours of electricity per year is guaranteed.

The connected load in the city hall will be about 15,000 16-cp lamps and 1191 hp in motors, the latter distributed as follows: Elevators, 450 hp; ventilation, 375 hp; fire pumps, 270 hp; house pumps, 30 hp; vacuum cleaning, 15 hp; refrigeration, 15 hp; pneumatic tubes, 20 hp. The Sanitary District, which produces hydroelectric energy from the Chicago Drainage Canal, will install duplicate underground circuits between its terminal station at Thirty-first Street and Western Avenue and the city hall. A main distributing switchboard will be located in the engine-room in the basement of the city hall. There will be three motor-generators, meters and such other apparatus as may be necessary for delivering and regulating at the main distributing board direct current at a pressure of 115 volts for lighting and 230 volts for motors. Any two of the motor-generators shall be of sufficient capacity to supply the entire requirements of the city hall.

An interesting feature of the city hall plant will be a storage battery to insure continuous service. The Sanitary District agrees to install a battery of sufficient size to carry the entire power and lighting load of the city hall, and this battery shall be cross-connected and designed for operation in connection with, or independent of, the other apparatus. It is to be of a rating sufficient to carry the average load for a period of six hours, the average peak load for a period of two hours, and the maximum peak load for a period of one hour. The Sanitary District also agrees to regard the city hall as superior to commercial and private patrons, and to give the city service preference over its commercial and private service. The city will provide the main distributing switchboard and the equipment for receiving the electrical energy supplied by the District. The meters are to be placed on the main distributing switchboard on the 115-230-volt side of the system. Bills are to be rendered and paid monthly. Provision is made for the testing of the meters. The term of the contract is for a period of five years. The District agrees to use reasonable diligence to provide regular and uninterrupted service, but does not guarantee a constant supply of electricity.

Financial Results of a Year's Operation of Chicago Drainage Canal Hydroelectric Plant.

A report of more than usual interest is that made to President R. R. McCormick and the board of trustees of the Sanitary District of Chicago showing the financial statement of the Electrical Department for the year ended Dec. 31, 1909. The report is made by Mr. D. M. Deininger, comptroller of the Sanitary District, and is dated March 31, 1910, although but recently made public. In his letter of transmittal to Mr. McCormick, Mr. Deininger says that on April 1, 1909, a complete system of accounts was installed, and during the nine months ended Dec. 31, 1909, all charges and transactions of the Electrical Department were recorded as prescribed by this system. Some confusion resulted in introducing this system, but the figures for the year are as nearly correct as circumstances permitted, and with a better knowledge of the requirements of the system, improved results can be looked for during the present year.

The Sanitary District is a municipal body operating the Chicago Drainage Canal, and the report is put forth as a careful attempt to state the true condition of affairs, in contrast to many other municipal reports. The figures given relate to the Electrical Department exclusively. Electricity is generated at a 24,000-kw hydroelectric plant at Lockport, Ill., where the water-power of the Drainage Canal is utilized. This electricity is sold to the city of Chicago and other municipal corporations for street lighting and other purposes, and also to some private consumers.

EARNINGS AND OPERATING EXPENSES, YEAR ENDING DEC. 31, 1909.

INCOME:			
Sales of Power and Light		$383,564.69	
Interest on Municipal Contracts		3,890.98	
Forfeited Discounts		1,439.66	
Cash Discounts		2,613.84	
Merchandise and Jobbing Revenue		279.20	
Interest		148.61	
Gross Income			$391,936.98
OPERATION AND MAINTENANCE EXPENSES (April to December, Inc.)			
Station Superintendence and Labor	$13,992.63		
Lubricants for Power	802.74		
Production Supplies and Sta'n Expenses	1,361.26		
Repairs of Power Plant Building	239.17		
" " Hydraulic Power Plant	839.19		
" " Power Plant Electric Equip't	1,247.72		
Miscellaneous Station Repairs	31.71		
Total Production Expenses		18,514.42	
Transmission Charges (*a*) Main Line	$4,104.26		
" " (*b*) Other "	9,183.72		
Underground Transmis'n System Repairs	1,061.10		
Terminal Station Labor	9,576.97		
Substation Labor	5,492.76		
Terminal Station Supplies and Expenses	763.69		
Substation Supplies and Expenses	582.25		
Repairs of Terminal Station Building	116.57		
" " Substation Buildings	316.98		
" " Terminal Station Equipment	745.28		
" " Substation Equipment	478.61		
Total Transmission Expenses		32,422.19	
Distribution Supplies and Expenses	$109.38		
Setting and Removing Meters and Transformers	1,222.71		
Overhead Distribution System Repairs	8,735.56		
Underground Distribution System Repairs	264.71		
Repairs to Electric Services	346.66		
" " Transformers	7,658.25		
Electric Meter Operation and Repair	1,948.89		
Total Distribution Expenses		20,286.16	
Commercial Incandescent Operation	$741.38		
Consumers' Installation Expenses	1,004.43		
Municipal Street Arc Operation	199.81		
" " " Repairs	346.96		
" " Incandescent Operat'n			
" " " Repairs	28.01		
Operation and Maintenance Utility Equipment	4,438.15		
Total Utilization Expenses		6,758.74	
Commercial Administration	$1,296.76		
Promotion Expenses	5,338.63		
Total Commercial Expenses		6,635.39	
General Office Salaries	$15,594.91		
" " Supplies and Expenses	2,315.42		
Miscellaneous General Expenses	517.57		
Insurance	690.96		
Accidents and Damages	214.25		
General Stationery and Printing	2,278.58		
Store and Stable Expense	584.28		
Taxes			
Depreciation	40,216.13		
Total General and Misc. Expenses		62,402.10	
Total Operation and Mainten'ce Expenses, Apr. 1 to Dec. 31, '09			147,019.00
Total Operation and Mainten'ce Expenses, Jan. 1 to Mar. 31, '09			36,433.40
Total Operation and Maint'ce Expenses for the Year			$183,452.40
Net Earnings			208,484.58
Interest on Cost of Plant and Equipment	$144,620.09		
Rental of Leased Lines	653.03		
			$145,273.12
Profit and Loss			63,211.46

Inasmuch as this report is of unusual character, and as it is of interest to see just how the charges are made, the statement of earnings and operating expenses for the year ended Dec. 31, 1909, is given in full in the above table.

It will be noted that the sum $40,216.13 is set aside for depreciation, and that the net profit of $63,211.46 is arrived at after deducting the interest on cost of plant and equipment, amounting to $144,620.09. No allowance is made for taxes.

The trial balance as of Dec. 31, 1909, is as follows:

TRIAL BALANCE, DEC. 31, 1909.

ASSETS

Cost of Plant and Equipment	$4,036,599.40	
Total fixed assets		$4,036,599.40
Material and Supplies	$103,776.13	
Cash	246.27	
Accounts Receivable—Consumers' Ledger	185,855.63	
" " —General Ledger	7,085.12	
Bills Receivable	1,753.99	
Prepaid Insurance	759.03	
Total current assets		299,476.17
Jobbing Orders in Progress	$16,291.90	
Construction Orders in Progress	3,675.71	
Total accounts to balance		19,967.61
		$4,356,043.18

LIABILITIES

Clerk of the District	$3,883,495.06	
Total fixed liabilities		$3,883,495.06
Accrued Rental of Leased Lines	$247.23	
Consumers' Line Deposits	10,839.88	
Consumers' Meter Deposits	40.00	
Audited Vouchers	117,660.95	
Retained Reserves on Contracts	46,282.62	
Storeroom Adjustment Account	401.10	
Inventory " "	15,393.01	
E. B. Ellicott Emergency Fund	25.00	
Total current liabilities		190,889.79
Interest Accrued	190,667.33	
Depreciation Accrued	63,951.19	
Total accounts to balance		254,618.52
Profit and loss		27,039.81
		$4,356,048.18

It will be noted that instead of the ordinary capital liability, the item "Clerk of the District" is inserted. This means that the amount appropriated for this department by the district is carried as a capital liability in an ordinary business.

The report contains many details, and is quite an elaborate one. It is shown that the average income per kw-hour for commercial lamp circuits is 4.65 cents, and for commercial motor circuits is 2.15 cents per kw-hour. The city of Chicago is the best customer of the Electrical Department of the Sanitary District, taking electricity during the year amounting to $14,184.77; the next best customer, apparently, is the Illinois Steel Company, whose bill was $34,376.03, while the International Harvester Company, with $20,250.76 comes third, and the fourth is a public institution, the West Parks Board, which was charged $14,664.50. All told, the proportion of output of electrical energy for the year used by public institutions was 67 per cent, the city of Chicago alone taking 56 per cent for its street lighting. The total number of consumers supplied with electricity by the Sanitary District during the year was 811; of these, 695 are classified as "commercial light," 103 as "commercial power," and 13 are municipal bodies. The total number of employees in the Electrical Department is 265; the largest individual group of these, 99 in number, is employed in the maintenance of overhead lines, while 42 employees are engaged in the construction of overhead lines, 27 on construction of underground lines, and 19 in the operation of the power house.

Electricity at Wellesley College.

One of the largest higher educational institutions for women in this country is Wellesley College, located in a beautiful suburban town about fifteen miles west of Boston. For a number of years electricity has been employed in various ways about the college campus and buildings to facilitate the comfort and convenience of students and staff, energy being derived from a central generating plant installed in a commodious brick structure in a hollow adjacent to the administration office building and Lake Waban. The electrical service of the college includes the illumination of the campus and buildings, and the operation of a considerable variety of machinery in the various dormitories, laboratories, recitation and library structures. The main campus occupies an area of over 100 acres, and there are over 6000 16-cp lamps or their equivalents on the property, including lamps in buildings. A complete telephone service connects all the departments of the college with a private branch exchange in the administration building.

The power plant contains 1000 hp in horizontal return tubular boilers, made by the Erie City Iron Works, Erie, Pa., and operated at 110 lbs. pressure. Bituminous coal is burned on the grates, and a storage yard is maintained by the college for this fuel. Three electric generating sets are installed in the power plant, their combined capacity being 425 kw. All are 2300-volt, two-phase outfits, driven by McEwen single cylinder, horizontal, high-speed engines. The smallest set is a 75-kw Westinghouse alternator, driven at 300 r.p.m. by a 14-in. x 12-in. engine; a second machine is a Westinghouse alternator rated at 150 kw, driven by a 16-in. x 19-in. engine, making 240 r.p.m., and the third unit consists of a 200-kw Stanley alternator, driven by a 21-in. x 20-in. engine, speed 200 r.p.m. All the units are direct connected, and the exciter of the largest unit is direct coupled to the generator.

The peak load on the plant is about 110 amp, at 2300 volts. Twenty-four hour service is supplied to the various buildings at 2300 volts, and current is delivered to motors at 220 volts, the lighting of interiors being on 110-volt circuits. Series incandescents of 3.5 amp capacity are used for the illumination of the numerous wooded paths and roadways in the college grounds. The motors are of the induction type, and are used in the driving of elevators, pumps, fans, light shop machinery, economizer scrapers, kitchen machinery and laundry equipment. A considerable number of electric flatirons are in use, these being operated at 175 volts. A number of large fans are in service in dormitory ventilation, the largest being driven by a 35-hp motor.

During the present year a new library was completed on the college grounds through the generosity of Mr. Andrew Carnegie. This building is provided with five book stacks, which are served by a Burdett-Rowntree 500 lb. book hoist, driven by a 7½-hp, 220-volt induction motor, making 1200 r.p.m. The motor is provided with an external resistance in the rotor circuit for use in starting. The operation of the elevator is automatic, with the exception of a push button control, which enables the hoist to be brought to the floor level of any stack. The ventilation of the library is effected by a fan about 48 in. in diameter, driven by a 3-hp General Electric motor. The departments of the library are connected by a Couch telephone system. The bookcase illumination is accomplished by pendant reflectors carrying two 50-watt lamps each, and the tables are lighted by standards carrying three 50-watt lamps each. In the astronomical observatory of the college electricity is used for illuminating telescopic fields, interior lighting and chronographic signaling.

Maryland Public Service Commission News.

Solicitor Poe, of Baltimore, has asked the Public Service Commission of Maryland to give a hearing on the subject of a reduction in rates for lighting service in that city. The commission has announced that no action would be taken at once, but that with the formal filing of the preliminary papers a place would be arranged for the case on the docket of the commission.

The act creating the Maryland commission stipulates that all gas and electric companies in the state must provide apparatus for the testing of meters under the direction of the commission. Baltimore now has at the City Hall a well-equipped department for the testing of gases and illuminating oils, and

gas and electric meters. A large portion of the apparatus was imported from Germany, and the equipment is valued at about $4,000. Lighting Superintendent McCuen has been requested to formulate plans for conducting this branch of the department and to submit the same to the commission at the earliest possible moment. The commission wishes to agree upon some method of testing the meters that will utilize the services of Mr. McCuen instead of conflicting with them.

The commission last week approved the application of the Susquehanna Transmission Company of Maryland to erect poles and wires across the public roads in Harford County. This is a company chartered for the purpose of providing the means for conveying electricity from the plant now being constructed at McCalls Ferry to Baltimore.

The Auxiliary Reality Company, of Baltimore city, last week filed in the Baltimore Circuit Court a bill against the Mayor and City Council for an injunction to restrain the city from paying the public service commissioners the extra salary which the act creating the commission threw on the city. The bill states that the company holds property assessed for taxation at $55,245; that the last Legislature passed a law creating a Public Service Commission and provided that while the State paid each of the commissioners $3,000, the city should pay $3,000 to the chairman and $2,000 to each of the other two members, and that this was done to avoid the constitutional provision that no salary greater than $3,000 should be paid to any State official; that the city never agreed to the passage of the law and never committed itself to this voluntary payment of the salaries; that the State has no more right to require the city to pay these extra salaries than to require this from any other individual or corporation in the State.

The commission is investigating complaints against the United Railways & Electric Company, of Baltimore, that it charges a 5-cent fare to a certain suburb and to another equally distant from the city the fare is 15 cents. The company has filed an answer to this complaint in which it says that the suburb to which the 5-cent fare is charged is open only in the summer and the rate is a special one for the summer season.

The office of the commission has been remodeled and a complete modern filing system has been purchased and installed.

Wisconsin Commission News.

The Wisconsin commission has dismissed the petition of the city of Merrill for an order requiring the Merrill Electric Light & Power Company to extend its lines in that city. The commission held that it had no authority to require the company to extend its lines in a case in which there was doubt as to whether the additional investment would be a paying one.

The commission recently handed down an order in the matter of the investigation of the rates charged by the Chippewa Falls Water Works & Lighting Company. This company operates two hydraulic electric plants, with generating capacities of 322 kw and 290 kw, respectively. Both are equipped to handle alternating-current lighting and direct-current arc lighting and power. The decision deals practically entirely with a detailed investigation of the physical valuation of the plant and its financial condition during the past several years. The commission concludes from the results of its investigation that the net earnings of the company, when taken as a whole, can hardly be regarded as excessive or unreasonable and that it would hardly be fair to require a general reduction in the rates.

A careful investigation of the rate schedules of the electric plant, however, and of the conditions under which it is operating has disclosed inequalities in the present rates for electric energy, as well as other conditions, that appeared to require a rather thorough-going readjustment. According to the exhibit of consumers the schedule of charges under existing metered rates varied from 6 cents to 15 cents per kw-hour, and under flat rates from 10 cents to 60 cents per 16-cp lamp per month. To rectify existing inequalities the company proposes to meter all commercial lighting service, and the uniform schedule which follows was worked out at the company's request. From an analysis of operating expenses the following table of unit costs has been prepared in a manner similar to that outlined in these columns last week.

TABLE OF UNIT COSTS.

Capacity Cost	Output Cost	Total Cost	Daily use of connected load, hour
$8.17	$4.79	$12.96	1
4.07	4.79	8.88	2
2.72	4.79	7.52	3
1.63	4.79	6.43	5

For all lighting service Classes A, B and C (defined below), including such incidental use of appliances for heating and power used on alternating-current lighting circuits and passing through the same meter, the rates are to be as follows, the minimum bill for service rendered being $1 per month:

Primary Rate, 13 cents per kw-hour for energy used equivalent to, or less than, the first 30 hours' use per month of the active connected load.

Secondary Rate, 8 cents per kw-hour for additional energy used equivalent to, or less than, the next 60 hours' use per month of the active connected load.

Excess Rate, 5 cents per kw-hour for all energy used in excess of the above 90 hours' use per month of the active connected load.

In Class A, consisting of residences, flats and private rooming houses where the total connected load is equal to or less than 500 watts nominal rated capacity, 60 per cent of the total connected load shall be deemed active; where the installation exceeds the above value, 33⅓ per cent of that part of the total connected load over and above 500 watts shall be deemed active.

Class B consists of stores, saloons, theaters, depots, halls, banks, etc. In this class 80 per cent of the total connected load shall be deemed active except such portion used for signs, window and show-case lighting, where 20 per cent shall be deemed active.

In Class C, 55 per cent of the total connected load shall be active. This class includes factories, hotels, clubs, churches, public buildings, etc.

The commission states that the company shall not be required to install meters at its own expense for any consumer in Class A having an installation of less than five 50-watt lamps or the equivalent thereof, nor for any consumer in Classes B and C using less than three 50-watt lamps or the equivalent thereof. A graduated scale of flat rates is authorized in addition to the schedule previously given.

The company contemplates changing its power service from alternating to direct current, obtaining its power from Eau Claire, and placing such consumers on a metered basis. Pending such changes the commission did not find it expedient to alter the present unsatisfactory flat-rate schedule for motor circuits. Although the present cost of the arc service is relatively high, no change in the rate was made, but the commission suggested that the high cost of service could be reduced by adopting a more efficient type of lamp than that now specified in the contract with the municipality.

The Antigo Gas Company has been authorized to issue 750 shares of common stock, of par value $100 each. This stock is to be sold for money only and for not less than par value. The proceeds of the sale are to be used for the purpose of supplying the company with funds for the construction of a gas plant in the city of Antigo.

That portion of the annual report for the year ending June 30, 1909, which deals with the statistics of the electric utilities has been completed. Both the financial and physical statistics are given in considerable detail. As this is the first report under the new classification, a comparison with the previous report would be impracticable.

The statistics show that the total operating revenues from the 26 Class A electric utilities (cities of over 10,000 population) was $2,646,039, divided as follows: Commercial lighting,

$1,464,336; municipal contract lighting, $864,763; commercial power, $474,525; municipal power, $20,648; sales to other utilities and miscellaneous earnings, $321,765. The total operating expenses were $1,645,636. The most important items of expense were: Power, $758,309; distribution, $113,966; consumption, $146,659; commercial, $67,439; depreciation, $184,647; taxes, $140,545. The gross income of the 26 companies was $1,147,751 and the net income $545,204. Dividends were declared by 12 companies amounting to a total of $309,541 on a total valuation of $11,846,284.

The total operating revenues of the 65 Class B utilities were $666,755; the total operating expenses, $529,603; the net income, $109,963. Twelve companies showed a deficit, while 12 companies declared dividends amounting to a total of $20,650.

Eight of the 83 smaller companies declared dividends amounting to a total of $4,498.

The total valuation of the electric lighting plants covered by the report was $23,257,276.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has issued an order approving the issue by the Taunton Gas Light Company of 1200 shares of new capital stock of the par value of $50 each, at a price of $90 per share as determined by the directors of the company, for the purpose of cancelling bonds outstanding to the amount of $80,000, and of other obligations to the amount of $30,000, represented by promissory notes outstanding June 1.

The Pittsfield Electric Company has petitioned the board for authority to issue new capital stock to the amount of $223,000 par value, the directors having fixed the price per share at $120, and the number of shares desired being 2250. The proceeds of the issue are to be employed in payment for additions to the power plant of the company at Silver Lake, extensions of its systems of poles and wires and the payment of floating debt incurred for purposes of construction.

The board has approved of the issue by the Easthampton Gas Company at $100 per share of 1000 shares of new capital stock of the par value of $100 each for the payment of notes and the cost of plant additions.

The Taunton Gas Light Company has petitioned the commission for the right to supply gas in the town of Berkeley.

The Leominster Electric Light & Power Company has petitioned the board for authority to issue 700 shares of new capital stock of the par value of $100 each, such additional shares to be offered to stockholders pro rata at $100 each, the proceeds to be used for the payment of the present floating indebtedness of the company, incurred in the enlargement of its plant and extensions of its distributing system, and also for further proposed enlargement and extension. The Leominster Gas Light Company has petitioned the board to approve an issue of 750 shares of new stock at the par value of $100 each, the proceeds to be used in enlarging the plant.

A hearing was given on June 16 by the Massachusetts Railroad Commission upon the petition of the Selectmen of Framingham and Hopkinton for a reduction in the fare from 10 cents to 5 cents between the two towns on the line of the Milford & Uxbridge Street Railway Company. A large amount of evidence was heard by the commission, and on June 24 the final arguments were presented. Wendell Williams, Esq., conducted the case for the railway company. He contended that the cost of living to street railways has gone up so fast in recent years as to make it impossible to carry traffic at the old rates, and submitted considerable tabular data showing that the fares on country lines running out of Worcester, South Framingham and Milford compared most favorably with those in force since June 1 on the Milford & Uxbridge. From 10 cents to 12 cents is charged on these lines for journeys of from 4 miles to 8 miles. The petitioners claimed that the company is discriminating against South Framingham and Hopkinton in raising the fare on June 1 from 5 cents to 10 cents, but in reality the discrimination has long been against the other towns on the company's lines, some of which have complained repeatedly that the old 5-cent fare to South Framingham induced purchasers to go there instead of to points like Milford. Wages have been increased 10 per cent on the Milford & Uxbridge line in recent years, and the dividends have averaged 1½ per cent or less for a long period. The claim of the petitioners that a 5-cent fare was agreed upon as a part of a turn-out franchise in Holliston is legally out of order on the basis of the celebrated decision of the Supreme Judicial Court of Massachusetts in the case of Keefe vs. Lexington & Boston Street Railway Company, 185 Mass., 182, and also on the strength of subsequent decisions.

New York Public Service Commission News.

The Public Service Commission, First District, last week sent a letter to Mr. E. W. Winter, president of the Brooklyn Union Elevated Railroad Company, practically declining to consider the offer his company had made to operate its trains through a portion of the city's new subway under Delancy and Center streets. The commission said that, in its opinion, the offer was far too low; that the portion of the subway which the railroad proposed to use had cost at least $7,500,000, instead of $4,000,000, the sum upon which the railroad proposed to pay interest. The commission pointed out the advantages to the company in the operation of this road, but said that as it was necessary for the city's bonds, which had been issued to pay for subway construction, to be self-sustaining in order that they might be exempt from the debt limit, it would not be good policy for the city to enter into a losing contract. The letter concluded by inviting the officials of the railroad company to a conference. This invitation was accepted by the officials and a conference held without any definite result being reached. In attending the conference, Mr. Winter, president of the company, filed a letter with the commission defending the first offer that had been made.

The commission has decided to give immediate attention to the proposition made by certain civic organizations in South Brooklyn for the construction of a rapid transit line in Nostrand Avenue and Eastern Parkway, Brooklyn, to be paid for on the assessment plan. A majority of the property owners along the route have consented to the plan, and a formal hearing will be held on the proposition July 1.

The Public Service Commission has adjourned the hearing as to the rates charged for electricity by the Queens Borough Gas & Electric Company until July 12.

The Board of Estimate and Apportionment has approved the plan which Fire Commissioner Waldo has prepared for the betterment of the fire-alarm system in New York. Money will be appropriated for this purpose and for the betterment of the Fire Department generally amounting to $2,200,000. Of this sum more than $400,000 will be spent for the fire-alarm system—$207,000 in Manhattan and the Bronx; $150,000 in Brooklyn; $10,000 in Queens, and $43,000 for new fire-alarm boxes. The principal changes contemplated are placing the wires underground wherever possible, and using heavier cables where it is necessary to have the wires overhead.

Corporation Counsel Watson rendered an opinion last week, on the request of the Board of Estimate, upon the franchise of the Edison Electric Illuminating Company in the Thirtieth Ward of Brooklyn. After investigating the matter, he decides that this company has no franchise to operate in that territory. The board then adopted a resolution instructing Borough President Steers, of Brooklyn, to remove all poles and overhead wires in that section. The company's counsel was informed that if it is expected to continue furnishing light in the Thirtieth Ward it will be necessary to apply for a new franchise. The Brooklyn borough president said that he would not be over-hasty in having the poles and wires removed if the company would file its application for a regular franchise at once.

The Board of Estimate and Apportionment last week resurrected from the files and placed upon the calendar the application of the Independent Telephone Company for a franchise

to operate in the city of New York. This application was made in 1907 and has been slumbering ever since in the office of the corporation counsel. The president of the company, Mr. Louis Annin Ames, of 99 Fulton Street, says that his concern is willing to take the franchise now on the same terms he offered four years ago. The company then offered to pay the city a tax of $1 a year for every telephone it installed and to guarantee a payment of $100,000 a year. Mr. Ames says that his company will operate an automatic device and that it will be able to make a general reduction in toll rates. A hearing has been ordered on this franchise for Sept. 16. There are also in the files of the board two other applications from telephone companies, known as the Atlantic and the Star. If these companies are now in existence, they have not as yet been located.

The Public Service Commission, Second District, has received an application from the Poughkeepsie Light, Heat & Power Company, Newburgh Light, Heat & Power Company and Hudson Counties Gas & Electric Company for leave to consolidate into a single corporation to be known as the Central Hudson Gas & Electric Company. The companies sought to be consolidated supply gas or electricity, and in some instances both, to the city of Poughkeepsie and towns of Poughkeepsie and Hyde Park, Dutchess County; towns of Lloyd, Marlborough, Gardiner, Shawangunk, Plattekill and New Paltz, Ulster County; and village of Cornwall and towns of Cornwall, Newburgh, New Windsor and Blooming Grove, Orange County. The directors of the new company will be Messrs. E. E. Perkins, J. W. Hinkley, A. G. Tobey, George A. Voorhees, of Poughkeepsie, N. Y.; Francis N. Bain, Hugh M. Beugler, Albert R. Beal, William R. Beal and Thaddeus R. Beal, of Newburgh; and John E. Wilkie and Rolland A. Davidson, of New York.

The basis of the proposed consolidation is the exchange at par by the outstanding stock in each of the consolidated companies for stock in the new company. The amount of capital stock of the new corporation is to be $2,500,000, all of which is to be common stock. The new capital stock is to be issued $500,000 to the holders of capital stock of the Poughkeepsie Light, Heat & Power Company, $500,000 to holders of capital stock of the Newburgh Light, Heat & Power Company and $100,000 to holders of capital stock of the Hudson Counties Gas & Electric Company. The companies state in their application that intercorporate relations have developed, and from the standpoint of economy of management of the allied businesses and of the quality and extent of the services to be rendered to the public, a merger or consolidation of these separate companies into one company would be most desirable, if not absolutely necessary.

The commission has received an application from the Hudson Valley Railway Company for permission to construct an extension of its lines in the villages of Saratoga Springs, to lay its tracks upon and through East Avenue and crossing Union Avenue. The village of Saratoga Springs has granted a franchise for the proposed extension. The extension will connect the Glens Falls Division with the Waterford Division, making a continuous line of railroad from the city of Glens Falls on the north to the village and town of Saratoga Springs and southerly to the village of Ballston Spa, Mechanicville, Waterford and the city of Troy. The connection will also make it possible to run through cars from the cities of Albany, Troy and Schenectady via the Schenectady Railway and Hudson Valley Railway to Lake George and Warrensburg.

The commission has granted its consent to the receivers of the Hudson River Electric Power Company for the extension of a lease for the steam power plant and property at Utica, the apparatus contained in the substations at Little Falls, Frankfort and Oriskany and the high-tension line from Utica to Clark Mills to the Utica & Mohawk Valley Railway Company. The extension is granted during the life of the receivership of the petitioning company. The extension of lease is in accordance with the terms and provisions of an agreement of extension and an order entered by the United States Circuit Court of the Northern District of New York authorizing the extension of said lease.

The commission has authorized the transfer by Elizabeth Pierce, Howard A. Pierce and Laura S. Frank of the works, system and franchises of the water-power plant at Water Valley, a transmission line from Water Valley to the village of Hamburg, and distribution system in the village of Hamburg to the Howard A. Pierce Electric Light Company. The commission has also authorized the Howard A. Pierce Electric Light Company to issue its capital stock to the amount of $12,500 to be used for the purchase, when it sees proper, of the property in question.

The commission has closed upon its records the complaint of the Common Council of the city of Oneonta against the Oneonta Light & Power Company in relation to service, it appearing that the company has purchased and installed a switchboard as required by the order of the commission.

The commission has authorized the Hornell & Bath Interurban Railway Company to issue $195,000 par value of its bonds, the proceeds to be used in connection with the construction of the company's line from Hornell to Bath, Steuben County. Previous authorization allowed the company to issue $450,000 of bonds, and the amount now allowed is in addition thereto.

The Public Service Commission, Second District, will give further hearings this week on the complaints of residents of the villages of White Plains, Port Chester, Eastchester, Tarrytown, North Tarrytown and Irvington against the Westchester Lighting Company as to quality and price of gas and electricity in these communities.

The commission has, after hearings and personal investigation of the street railway conditions in the city of Watertown, sent a communication to the Black River Traction Company in regard to the conditions in that city. From the evidence submitted and personal examination of the territory by the entire commission the commission is of the opinion that the city of Watertown has outgrown the existing street-car facilities afforded. It believes that the city is entitled to more extensive service over territory not now covered by the existing tracks and that additional service could be provided upon the tracks which now exist. The commission asks to be informed whether the company has under consideration any plans for the growth and extension of its service, and calls attention to the fact that the diminution of operating receipts is fairly indicative of a failure to meet the demands of business, which failure should not be permitted to continue. Attention is called to the fact that at the present time there are no directors of the company residents of the city of Watertown and the commission suggests that good business policy requires that the management of the company be put in more direct touch with the needs and requirements of the city by the election of a suitable number of directors residing in the city who are interested in its welfare and who properly appreciate that the interests of the city and of the company are identical and that the growth and prosperity of both depend upon harmonious co-operation and an effort upon the company's part to supply all legitimate needs of the residents of the city for transportation. Attention is called to a promise that the company will extend its present terminus to a point nearly opposite the works of the New York Air Brake Company, provided the necessary local franchises and local consents can be obtained, and directs that immediate application for such franchise be made to the city authorities. The commission states that upon obtaining such franchises and consents the commission will promptly grant its approval to the exercise of the franchises unless at such time matters are brought to the attention of the commission of which it now has no knowledge or information. The commission also asks that assurances that the track on State Street shall be reconstructed in such a manner as to make it proper for use shall be promptly carried out. Attention is also called to the fact that open cars should be provided during the summer months and the commission gives as its opinion that this would add largely to the convenience and comfort of the patrons and enhance materially the revenues of the road. The company is requested to state whether it will not continue on its own motion placing open cars in service.

The Institution of Electrical Engineers, Great Britain.

THE Institution of Electrical Engineers of Great Britain was founded in 1871, and now has a membership of over 6200. Although the youngest of the larger institutions representing engineering science in Great Britain, it has made such rapid progress under the wise guidance of a succession of able presidents, councils and secretaries that it has for many years past ranked in importance and numerical strength as the second leading engineering institution in the country.

It may be of interest to record here the early beginnings of the Institution. The inaugurators of the movement which led to its foundation were Major (later Sir) Francis Bolton and Captain (later Major-General) Charles Edmund Webber, the first president being Mr. (later Sir) Charles William Siemens. Among the first members were Wheatstone, Cooke, Morse, Thomson (later Lord Kelvin), Tyndall, and many other pioneers. The first honorary members were Sir George Airy, Sir Edward Sabine and Prof. William Weber. The first paper to be read was by Mr. R. S. Culley on automatic telegraphs. By 1878, when Sir William Siemens, who had been elected president a second time, delivered his inaugural address, electrical science had extended in new directions, and he dealt not only with telegraphy but also with telephones, dynamos, lighting, and electrochemistry. In 1879 Mr. (now Sir) William Preece gave a demonstration of arc lighting before the Prince of Wales (later His Majesty King Edward VII) at the Royal Albert Hall, London. Looking through the back volumes of the *Journal* of proceedings from 1880 to 1890, we find among a number of epoch-making papers: "Induction Between Parallel Wires," by O. Heaviside; "The Theory of Alternating Currents and Magnetism," by John Hopkinson; "Self-induction and Magnetism," by David Hughes; "Meters and Motors," by Ayrton and Perry; "Measuring Instruments," by Lord Kelvin; "Magnetism," by Gisbert Kapp, and "Oscillatory Discharges," by Sir Oliver Lodge. The *Journal* of proceedings has now reached its forty-fourth volume, and is recognized as a standard compendium of information on electrical subjects.

Since 1898 the Institution has also undertaken, in association with other societies in England and in the United States, the publication of *Science Abstracts*, a monthly journal which contains a brief account of all recent work in physics and electrical engineering, forming a valuable record of the progress of science. The Institution is also one of the supporting bodies of the National Engineering Standards Committee and of the International Electrotechnical Commission. Its nominees on the main committee of the first mentioned body, which since 1901 has been carrying on an important national work in industrial standardization, are Sir William Preece and Col. R. E. B. Crompton. A number of sub-committees dealing with electrical branches of industry are recruited from members of the Institution. A warm interest has been taken in the work of the International Electrotechnical Commission, the organization of which was recommended by the Chamber of Delegates of the St. Louis International Electrical Congress, 1904. In addition to a main committee from the Institution associated with that body, and known as the British Electrotechnical Committee, there are sub-committees on nomenclature, on symbols and on the international unit of light, of which the chairmen are respectively Mr. A. P. Trotter, Lord Rayleigh and Dr. R. T. Glazebrook. A list of electrical terms with explanations, which has been under preparation for several years by the sub-committee on nomenclature, will shortly be submitted to the various committees abroad of the Electrotechnical Commission for their consideration. The Institution has hitherto borne the whole of the cost of the British committee, amounting on an average to about $1,250 per annum.

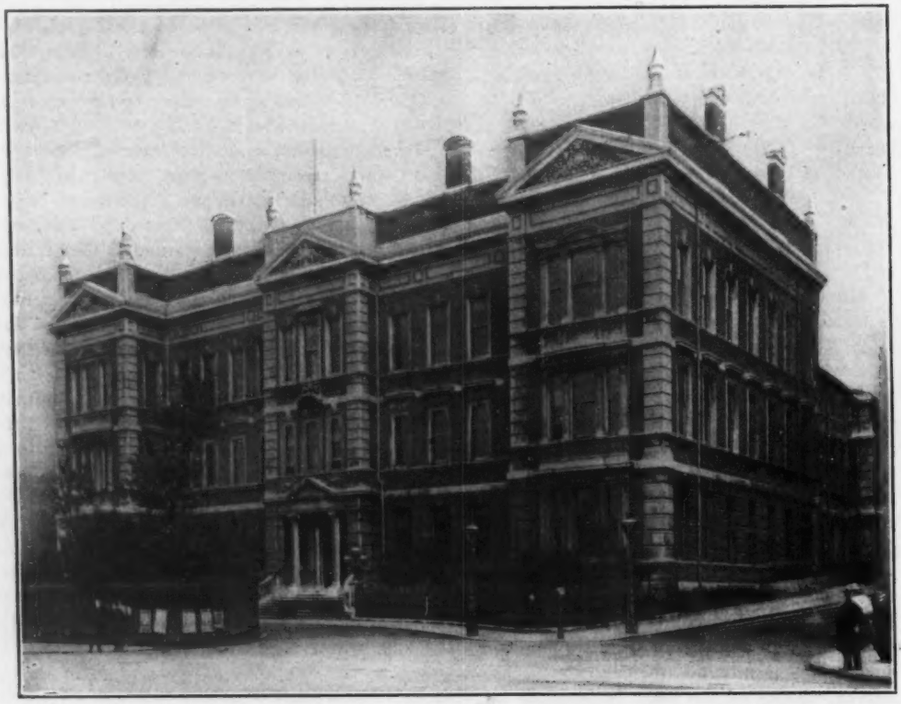


Fig. 1—New Home of Institution of Electrical Engineers, Victoria Embankment, London.

The affairs of the Institution are carried on by a council consisting of a president, the past-presidents (numbering 16 in 1910), four vice-presidents, 15 members, 3 associate members or associates, 7 chairmen of local sections, and the honorary treasurer. The president is chosen from the present or past vice-presidents, and the vice-presidents from the present or past members of council. Provision is made in the articles of association for the annual retirement of the president, two vice-presidents, the honorary treasurer, five members, one associate member or associate and all the chairmen of local sections, but they are immediately eligible for re-election, if they have not held office in the same capacity for more than three years in succession. Nominations for existing or coming vacancies on the council, not including section chairmen, are made by that body, but additional nominations may be made upon petition of 10 members. The council in addition to appointing com-

mittees from its own body, also names committees for special purposes, which include members of the Institution who are not members of the council.

The total number of members of the Institution, according to the last report of the Council, May 26, 1910, was 6222, as follows: Honorary members, 7 (one of whom is Prof. Elihu Thomson); members, 1173; associate members, 2629; associates, 938; students, 1370; foreign members, 105. All members are elected by ballot at any regular meeting of the Institution, after prior approval by the council of their applications.

The requirements for a member are rigorously professional in character, except that one is eligible for this grade who as an associate member shall have gained the senior premium in any year for a paper presented before the Institution, or who shall be so prominently associated with the objects of the Institution that the council considers his admission to membership would conduce to the interests of that body.

Associate members form a junior professional grade. Associates are persons who are interested in or connected with electrical science or engineering, or who are so related with the applications of electricity that the council considers their admission as associates would conduce to the interests of the Institution.

Those in the student grade must at the time of election be serving pupilage to an electrical engineer or electrician, or studying electrical science at one of the universities, public colleges, technical institutes or government schools. No person may remain in the class of students longer than three years unless at the expiration of that term he shall not have attained the age of 26 years. Foreign members are foreigners residing abroad.

The annual dues of members are $15; of associate members and associates, $10; of students and foreign members, $5. Annual dues may be compounded by the payment of various sums for the several grades, and the constitution requires that all such compositions must be invested and the interest alone appropriated to the current expenses of the Institution.

One of the clauses of the memorandum of association defines the first object of the Institution as the advancement of electrical science and its applications, and to this clause as broad an interpretation has been given as is consistent with the avoidance of controversial matters and the maintenance of a fair attitude toward the various sections of the electrical industry. In point of fact, far from confining its activities strictly to the scientific side of electrical engineering, the Institution, soon after it attained a position of strength, began to devote attention to matters of an industrial or legislative nature. Its advice and co-operation have on many occasions been called into requisition by Government departments, and at other times the council has taken the initiative in approaching the public departments in regard to bills before Parliament or in reference to matters requiring legislation. Directly and indirectly the Institution has been asked at various times to organize some association to improve the industrial conditions of electrical engineering, but the view most generally expressed has always been that such work would be outside the objects for which the Institution was founded, and would only tend to impede its all-important scientific mission.

In 1901 the council appointed a committee to consider what action might be taken to assist the industry in connection with the restrictive character of the legislation governing the initiation and development of the electric power and traction undertakings in Great Britain. The committee heard the reasoned evidence of a number of persons prominently connected with the electrical undertakings, and subsequently published the evidence so collected in a volume of some 190 pages. As a result of the committee's report, a deputation of members of the Institution waited on the Board of Trade early in 1902 and laid before that body the views of the Institution in regard to the effect on the electrical industry of the legislation by which it was governed, urging the removal of the disabilities under which they labored and which prevented the progress demanded by the national interests and the attainment of the same high level as in America, Germany and other industrial countries. Among the more recent matters which have engaged the attention of the council have been the London Building Act, the Workmen's Compensation Bill, the Home Office Rules for Factories and Workshops, and those for the Use of Electricity in Mines, and the Electric Lighting Acts.

Other matters to which the Institution has devoted considerable time and experience are the Rules for Wiring and the Model General Conditions for Contracts. The Rules for Wiring—which comprise rules for domestic wiring, including lighting, heating and cooking circuits, and wiring for power in factories and workshops—are revised from time to time by a standing committee appointed by the council. Reference to the last edition (April, 1907) shows that the committee was widely constituted so as to include representatives of all the various branches interested in the subject, with the result that in addition to receiving general acceptance and being recognized as the standard for good work, the rules have been adopted by an overwhelming majority of fire insurance offices, and they are regarded as embodying standard practice by nearly all the electricity supply companies and by all municipal electrical engineers.

The Model General Conditions for Contracts, which were

President Gisbert Kapp.

first issued in 1903 after being fully discussed at a general meeting of members, have been useful in laying down a standard set of conditions which electrical engineers and manufacturers have felt free to accept without qualms. It cannot, however, be said that their general acceptance is as widespread as it might be. Unfortunately, it is still often the case that those with whom it lies to determine the conditions which shall form the basis of an engineering contract are not engineers, with the result that an arbitrary set of conditions is imposed, sometimes with disastrous consequences to the contractor.

A feature which distinguishes the Institution from other engineering societies in England is the establishment of local sections, of which there are six in the United Kingdom (Birmingham, Dublin, Glasgow, Leeds, Manchester and Newcastle-on-Tyne) and two abroad (Calcutta and Cape Town). No less than one-third of the members reside within the area of one or other of these local sections, which thus afford to a large section of the membership an invaluable opportunity to take part in the debates and in the corporate life of the Institution. Each local section is governed by a chairman and a committee elected locally, and to allow the local committees the more readily to meet local conditions, each committee is empowered to draw up its own rules, but all the local sections are themselves subject to a general set of rules promulgated by the council. The activity of the local sections has in the past consisted chiefly in the reading and discussion of papers. All papers submitted for reading, whether at a meeting of the

Institution in London or at a local section, are adjudicated upon by a papers and editing committee of the council who meet in London at regular intervals. The principle is laid down that the same high standard of merit must be attained by all papers, wherever they may originate; and once accepted, the paper is read in London or at one or more local sections, or both if the matter be suitable for discussion at more than one place.

The local sections have been invaluable in keeping together the members residing at a distance from London and they have contributed materially in extending the sphere of usefulness as well as the influence of the Institution. They have also served in keeping the general body of members in touch with special applications of electrical engineering, as for instance, the electrical driving of textile factories and the use of electricity in coal mines.

It has been the custom of the Institution for more than 20 years to hold an annual conversazione. This has taken place for the last 10 years at the Natural History Branch of the British Museum, at South Kensington, and is attended by some 1200 to 1500 persons. It is the only function of the Institution as a body in which ladies take part and is highly thought of as the one opportunity for the meeting of town and of country members. Notwithstanding the perennial jokes at the annual inspection of the fossils and other curiosities which find their home in the Museum, the conversazione is undoubtedly a function of great popularity and one likely to continue a feature of the Institution. The only other social function is the annual dinner, which generally takes place early in the month of December. It is well attended by all the more prominent members of the profession, and the company has occasionally included a cabinet minister, and invariably many of the better-known public men of London. The numbers attending reach some 400, even 500 on special occasions, such as the memorable visit of the kindred institutions from abroad in 1906. The two functions by no means overlap, and each in its own way meets the needs of a particular section of the membership. The Institution has also at times organized foreign tours, the most noteworthy in recent years being the Swiss visit in 1899, the Paris Exhibition trip in 1900, the visit to Germany in 1901, the Italian tour in 1903, and the visit to the United States in 1904, when the visitors were royally entertained by the American Institution and their American confreres.

In 1875 the Institution acquired by deed of gift the great Ronalds Library of electrical books and pamphlets, which the late Sir Francis Ronalds collected during a long lifetime. This served as a basis of the present library, which comprises now 10,000 volumes. Several years ago a systematic inquiry showed that 1623 works were wanting to complete the Institution's collection of electrotechnical literature, and since then practically all of these volumes have been added to the library. For the more important books there is an annotated card catalog which greatly enhances the usefulness of the collection.

The income of the Institution for the year ending Dec. 31, 1908, was $58,115, of which $965 was from sales of the *Journal*, and $2,325 for advertising in the *Journal*. The salary roll was $9,590, and the expenditures for publications, $9,560, which includes a net allotment to *Science Abstracts* of $2,110. The expense for local sections was $2,825, and for the British Electrotechnical Committee, $1,185. The assets were $257,760, which include the Life Composition Fund ($27,775); the former building and site ($96,300); building fund ($81,660); various trust funds, library, etc. In 1908 the surplus was $16,265.

The Institution is the custodian of two funds, the proceeds of which are awarded as scholarships, namely, the Sir David Saloman's Scholarship Trust Fund, with an annual income of $250, and the David Hughes Scholarship Trust Fund, with an annual income of $250. The Institution is also the custodian of the Wilde Benevolent Trust Fund, and has also a Benevolent Fund set aside from its own resources. These funds are for the relief of necessitous members of the Institution and their families, a restriction in the case of the Wilde Benevolent Fund being that the members must have been full Members of the Institution; while in the case of the Benevolent Fund the class of membership is immaterial, at least five membership subscriptions to the Institution must have been paid. The capital of the Wilde Benevolent Fund consists of a donation of $7,500 from Dr. Henry Wilde, F.R.S., one of the earliest pioneers in dynamo work, and an accumulation of income since added to the capital, making a total of $8,725. The Benevolent Fund consists of donations from members of the Institution and electrical firms. One of the rules has been that until the capital reaches a total of $15,000 only the dividends from investments might be used for the relief of applicants, all donations and subscriptions being credited direct to the capital account. The limit has now been passed, and all revenue, whatever its source, is available as income applicable to the relief of necessitous cases. There is also a Kelvin Lecture Fund of a value of $4,930, the object of which is to afford the necessary revenue to provide an annual lecture in memory of the late Lord Kelvin. So far, two such lectures have been delivered, the first by Prof. Silvanus P. Thompson, F.R.S., in 1908, and the second by Prof. J. A. Ewing, F.R.S., Director of Naval Education, in 1910.

The council awards a number of annual premiums for papers and communications, those for 1908 being as follows: Institution Premium, $125; Paris Electrical Exhibition Premium, $50; Original Communication Premium, $50; three extra premiums, $50 each; three extra premiums, $25 each; First Students' Premium, $50; Second Students' Premium, $25; three extra Students' Premiums, $25 each. In 1894 and 1907 the Institution, in conjunction with the Institution of Mechanical Engineers, awarded a gold medal instituted in honor of the late Peter William Willans.

On June 1, 1909, the Institution purchased from the Royal Colleges of Physicians and Surgeons their building on the Victoria Embankment, London, close to the northern end of Waterloo Bridge, occupying an area of over 20,000 sq. ft., and consisting of a basement and four floors. The property was purchased for $250,000, of which $120,000 was paid from the accumulated funds of the Institution, a mortgage being executed for $130,000. In addition, an expenditure of about $100,000 was applied to alterations in the new building, for equipment, etc., which is approximately balanced by the value of the old building. The alterations include an entirely new lecture theater to seat 450 persons, a large main library of an area of some 3000 sq. ft., facing the Thames, reading and writing rooms for the members, and ample office accommodation for the permanent staff. It is expected that it will be ready for occupation the present summer. The attainment of this long-felt want for the provision of which the council and the members have for many years been accumulating a building fund, will, it is hoped, lead to a large accession to the membership. The accompanying illustration is from a recent photograph of the building.

The president now holding office is Prof. Gisbert Kapp, of the University of Birmingham. After graduation from the Polytechnic School in Zurich at the age of 17, in 1869, and employment for some time in engineering work in Germany, Mr. Kapp in 1875 went to Great Britain, where he soon became a prominent member of the electrical profession. In the fall of 1894 he left England to accept an appointment as secretary to the Verband Deutscher Elektrotechniker, and to take the editorship of the *Elektrotechnische Zeitschrift*, becoming also a lecturer on electrical engineering at the celebrated Technical High School at Charlottenburg. In December, 1904, he was recalled to England to occupy the newly created chair of Electrical Engineering at the University of Birmingham. Mr. Kapp's name is connected with a large number of inventions relating to electrical engineering, including a system of compound winding; a class of electrical measuring instruments; self-regulation of constant potential and constant current dynamos; an alternating-current dynamo; high-speed steam engine; a system of alternating-current distribution; a transformer; electric railway booster, etc. He is the author of a number of well-known books on electrical engineering, which have been published in English, French, Italian, Russian and German translations.

CURRENT NEWS AND NOTES.

Street Railway Passes for the Blind.—Since August, 1909, the Bradford (England) City Tramways have been carrying the blind people of the city free of charge, a numbered pass being issued to each blind person.

Proposed Wiring Ordinance for Pasadena.—It is reported from Pasadena, Cal., that a new ordinance governing the installation of electrical wires and apparatus will be drawn up by the legal department of the city and presented to the City Council at no distant date. It is alleged that faulty wiring has caused fires.

Portable Telephone on Lehigh Valley Passenger Trains.—The Lehigh Valley Railroad Company, operating between New York and the West, is placing portable telephones on its through passenger trains with "fish poles" to connect with the line wires at any point on the road.

Belgian Telephony and Telegraphy.—Statistics show that the number of telegrams sent in Belgium in 1908 was 3,576,539, the receipts from which were $397,117; also 3,325,856 international telegrams, the receipts from which were $512,587. The telephone service gave a revenue of $1,847,590 from 34,027 telephone subscribers and 199 public telephone stations.

A Meter for Every Lamp-Post.—Possibly owing to the existing dispute over rates, no bids have been submitted by the electric service companies for the proposed special ornamental street lighting on West Pico Street, Los Angeles, Cal. It is suggested that the abutting property owners may install meters on all the lamp-posts in order to compel the furnishing of electricity from central-station service.

Annual Meeting of the Municipal League of Indiana.—The twentieth annual meeting of the Municipal League of Indiana was held at Richmond, Ind., June 21 and 22. About 200 delegates were in attendance and the chief topics of discussion centered about municipal ownership, government by commission, public utilities commissions and track elevation. Mayor L. S. Darrow, of Laporte, was elected president and Mr. F. B. Robinson, of Crawfordsville, secretary. The 1911 meeting will be held in Crawfordsville.

Southern California Edison Employees at a Picnic.—About 600 employees of the Southern California Edison Company, of Los Angeles, enjoyed a picnic at Point Firmin on June 18. There was a barbecue, followed by sports and games of all kinds. The day was passed very pleasantly under the auspices of a committee of arrangements consisting of Messrs. William Dieterle, Benjamin F. Pearson, F. H. Percival, M. Marks, C. H. Pierson and W. P. Touhy. Dr. H. C. Stinchfield was chairman of the reception committee.

An Old Arc-Light Machine.—At the Colorado Electric Club luncheon, on June 24, Mr. Earl Taylor, power engineer of the Denver Gas & Electric Company, presented the chairman, on behalf of the club, with a gavel made from the oak base of the first arc-light generator brought to Denver in 1881. This old generator was the first machine in the third city of the country to take up the electric light. It was sold to the Cheyenne Electric Light & Power Company several years ago, and has operated continuously up to the present time.

The Smoke Nuisance.—There has been some abatement in the warfare against smoke in Chicago, but with the return of Mrs. Charles H. Sergel, president of the Chicago Anti-Smoke League, from Europe, there may be increased activity. Mrs. Sergel contrasts Chicago with Berlin very unfavorably in the matter of freedom from smoke and general cleanliness. In fact, she found all European cities far ahead of the smoke-begrimed cities of the United States. The Illinois Central Railroad has been one of the chief offenders in the production of smoke in Chicago, and this fact has had much to do with the agitation for electrification.

An Electric Prize Fight.—The Baltimore show rooms of the Westinghouse Company were the center of attraction last week by reason of a novel window display that showed a miniature prize ring with two rubber balls to represent the contestants. The black ball was marked Johnson, while the white one was to represent Jeffries. The two balls were placed over a wire screen under which was an inverted fan that created a draft causing the balls to bump one another with a realistic effect. The seconds were wax figures and the whole scene was cleverly planned.

A Substantial Electrical Contribution.—The Commonwealth Edison Company of Chicago sent a check for $325,313.31 to the comptroller of the city of Chicago on June 23 as its compensation under the city ordinance for the year ended May 31, 1910. This amount is the largest which the city has yet received from this source. The report which accompanied the check showed that the business of the company from the sale of electricity during the year amounted to $10,824,469.90, while the receipts for the rental of conduit space were $5,792.21. On the former class of business the city receives 3 per cent of the gross amount and on the latter 10 per cent.

Pittsburgh Electric Men Celebrate.—On June 25, over 400 men, representing all the electrical interests of Greater Pittsburgh, celebrated at Bradford Park, the occasion being the annual outing of the Pittsburgh Electric Boosters' Club. Arriving at the grove, each car was met by the reception committee and band. Following a luncheon were a number of athletic contests, the sports concluding with an exciting ball game. The party returned to the city in special cars in the early evening. Credit for the success of the outing is assigned to the executive committee, consisting of Messrs. C. B. Cushing, O. R. Rombaugh, L. Hommel, O. R. Lepper and H. B. Parke.

Coal as a Climatic Agent.—Mr. Samuel Craig Baker, of Brockport, Ill., has given warning No. 2 to humanity, pointing out that owing to man's ignorance of certain natural laws, climatic changes unfavorable to human life are occurring. He asks doubting science to consider the following proposition: "You know that coal has no energy but its weight; burn it in a furnace and it develops enormous energy. If its gas is increasing in the atmosphere, is it not fair to suppose that under the sun's influence it is still a source of terrible energy—and that climatic disturbances are evidences of its energy?" In conclusion Mr. Baker says that, having pointed out the true cause of increasing climatic evils, the obvious remedy is to install water-power on an enormous scale to take the place of steam power, and to plant trees on an equally great scale in order to purify the air.

Wireless in German Fisheries.—United States Consul-General Robert P. Skinner, at Hamburg, states that three Cuxhaven steam trawlers are now equipped with wireless telegraph apparatus, and the service is so satisfactory that efforts are being made to increase it. The most marked advantages resulting from the use of the wireless telegraph in this business are the ability of captains to advise with each other at sea as to their respective catches, and the transmission of similar reports to Cuxhaven a number of hours before the return of the ships to port. Thus vessels of the same fleet which have found poor fishing are sometimes able to join other vessels more fortunately located, in time to return with good catches. All the vessels are then able to inform the managers of the public markets respecting the quantities of fish to be placed on sale, in such manner than in the event of unusual catches arrangements can be made in advance for distributing supplies in the least possible time. The receipt and transmission of hydrographic intelligence and reporting of breakdown in engines or other accidents of navigation are also features of importance.

Milwaukee Railway Licenses.—Basing his claim on an old city ordinance providing that the street railway shall pay $15 annually for each car operated, Mayor Emil Seidel has taken steps to collect $72,000 in back licenses from the Milwaukee Electric Railway & Light Company. The company maintains that the ordinance was repealed many years ago.

Patentees' Rights.—Congress has passed a bill permitting patentees to bring suit in the Court of Claims against the United States for patent infringement. The law is the result of charges that officers of the Government have used inventions for public purposes without compensation to inventors and without their consent. Amendments added to the original bill excepts Government employees and their assigns from the benefits, and excludes inventions accruing during an inventor's Government service.

An Obliging Electric Light Company.—One of the telephone journals tells about a small Independent telephone exchange near Columbus, Ohio, which has had some trouble in the operation of its lines at night, owing to the proximity of the high-potential, alternating-current circuits of the electric light company. It is said that, owing to the induction, it is almost impossible to hear over some of the telephone lines because of the noise, but the kindness of the electric company enables the telephone people to do some business in this situation. When a night call comes in for a physician, or any call which is believed by the operator to be urgent, she telephones the lighting company to shut off the supply of electricity in the village while the conversation is being held. With this request the electric light company obligingly complies, and the conversation is uninterrupted.

Liability for Telegrams.—The Court of Appeals has decided that the printed contract on the back of a telegraph blank purporting to exempt the company from liability for errors in transmission of messages unless it is repeated, does not cover a case of error caused by gross negligence, and to that extent affirms a judgment of $10,000 obtained by the Cotton Exchange firm of Stephen M. Weld & Company against the Postal Telegraph Cable Company arising out of an error by the telegraph company in transmitting an order to a New Orleans firm for a sale in futures which resulted in a sale at a lower price than the plaintiff had directed. On the other hand, the court has ordered a new trial of the case in question because the trial judge refused to charge the jurors to the effect that if they believed the transaction out of which the suit arose was a wagering contract they must find for the defendant.

New York Telegraph and Telephone Bill.—The bill extending the jurisdiction of the Public Service Commission, Second District, New York, to telegraph and telephone companies has been signed by Governor Hughes. In his memorandum filed with the bill the Governor said: "The bill as a whole should be approved. There are certain matters of importance, however, with respect to which the bill is open to criticism. The convenience of administration would be promoted, in my judgment, if the jurisdiction, particularly with respect to telephone corporations, were divided between the two commissions, as in the case of the railroads and gas and electrical corporations. The bill does not give a sufficiently wide control over the issue of securities. The issues of securities by domestic corporations of this class should be subject to the approval of the Public Service Commission, whether the money is to be expended within or without the State. With respect to corporations of its own creation this State should exercise complete supervision. As to this second matter particularly, amendatory legislation should be had."

Attack on Telegraph and Telephone Merger.—The validity of the combination of the American Telephone & Telegraph Company and the Western Union Telegraph Company has been directly attacked in an injunction suit obtained by the Postal Telegraph Company against a subsidiary Bell telephone company in New Mexico for a violation of a contract which the Postal company made with an independent telephone company last July for five years, by which the Postal company reached a number of towns in New Mexico by an extension of its service from El Paso to Silver City, N. Mex. That contract still has more than four years to run. A few weeks ago the New Mexico subsidiary Bell Telephone Company bought out the independent telephone company with which the Postal had this contract and then the subsidiary Bell company notified the Postal that the contract would be repudiated July 1 and connection cut off. The Postal company maintains that this action is due to a conspiracy between the Western Union and the Bell telephone companies to suppress competition between El Paso, Silver City and intervening towns and other parts of the country. Mr. George H. Fearons, general attorney for the Western Union, is reported as claiming that the suit is entirely a local proceeding, and that no question of merger is involved.

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on June 22 it was announced that the regular program of having one announced speaker to make the principal address at each meeting would be discontinued during July. Two of the July meetings will consist of informal debates on subjects of electrical interest, and two will be in the hands of the entertainment committee. It was also announced that the club will hold its annual outing during the month of August, the arrangements devolving upon the entertainment committee. The speaker of the day was Mr. George F. Stone, secretary of the Board of Trade of the City of Chicago. His subject was "The Relation of the Board of Trade to Commerce in General," and he gave a finished and eloquent speech showing that the history of commerce is the history of civilization; that boards of trade marshal the commercial forces of the world and that the Chicago Board of Trade, in particular, occupies a most important position in the commerce of the country, and, indeed, of the world. Mr. Stone devoted considerable attention to the system of buying and selling grain for future delivery. He defended this system as putting money in circulation and helping to keep the wheels of commerce moving. He deprecated, however, illegitimate and reckless investment on speculation.

Like the Sound of Martial Music.—Those indefatigable journalists who collect or invent anecdotes of more or less eminent personages, usually stories with a humorous turn, might avail themselves of a real incident that happened in Chicago a few days ago. During the proceedings growing out of the litigation begun by the holders of the "underlying bonds" of the Chicago Consolidated Traction Company, a hearing was proceeding before Judge Grosscup. Mr. Colin C. H. Fyffe, a well-known lawyer, was addressing the court on behalf of the bondholders. Mr. W. W. Gurley represented the Chicago Railways Company, and by his side was seated a quiet gentleman who said nothing, but appeared to be following the argument very attentively. From time to time Mr. Fyffe cast his eye on this unknown man, wondering what his interest was in the proceedings. Finally, at a lull in the argument, Mr. Fyffe determined to satisfy himself as to the identity of the quiet listener, and he asked Mr. Gurley, *sotto voce*, to enlighten him. "Why," said Mr. Gurley, in some surprise, "aren't you acquainted with Mr. Drum?" Then introducing the two, he added, "Mr. Fyffe, let me make you acquainted with Mr. Drum." Suddenly the coincidence of names broke upon Mr. Gurley, and he became convinced that he had stumbled accidentally on a real joke. "Fyffe and Drum ought to need no introduction," he said, and the lawyers were so tickled by it all that the judge insisted on knowing the secret of their merriment. Mr. A. L. Drum is consulting engineer for the Calumet & South Chicago Railway Company, and also a member of the No. 2 Board of Supervising Engineers, Chicago Traction.

DISTRIBUTION OF ENERGY IN COLORADO.

Substations of the Central Colorado Power Company.

THE issue for Jan. 27, 1910, contained an article on the transmission lines of the Central Colorado Power Company's system, which are operated at 100,000 volts and aggregate 182.2 miles in length. The system of this company supplies energy to Denver and Leadville for central station purposes, and for mining purposes to the camps in several counties, including those around Dillon, Leadville, Idaho Springs and Boulder. A map of the system was given in the issue referred to. In the issue for June 23, 1910, the Glenwood hydroelectric station of this system was described. The present article will describe the substations at which this 100,000-volt energy is received. These stations contain a number of interesting features for the high-tension engineer, as they represent advance practice in the handling of 100,000-volt lines, both in and near substations.

DENVER SUBSTATION.

The largest substation is at Denver, where two 100,000-volt lines converge. One of these is from the Glenwood generating station of this company, 153.4 miles distant, and the other is from the Boulder plant, 28.8 miles distant. This substation is located in the outskirts of Denver, and is for the purpose of stepping down from 100,000 volts to 13,000 volts, at which latter voltage energy is transmitted to the Denver Gas & Electric Company's station, where it is again transformed for ordinary central station distribution.

The two distinctive features of this substation are, first, the use of outdoor busbars for the 100,000-volt lines, and second, the housing of the transformers, high-tension oil switches and lightning arresters in separate buildings. A third feature which may also be mentioned as being somewhat unusual, is the use of a transformer repair house adjoining the transformer house, with special provisions for wheeling transformers out of their regular place in the transformer house, and hoisting their coils for inspection and repair.

The general arrangement of the building at the Denver substation is shown in Fig. 1. At the left is the lightning-arrester house, located directly under the incoming high-tension lines. The lines terminate at a tower just before they reach the high-tension switch houses, which are the central buildings in Fig. 1. The substation proper is at the right. The outdoor busbars are supported on low steel towers, between the high-tension switch buildings and the substation proper.

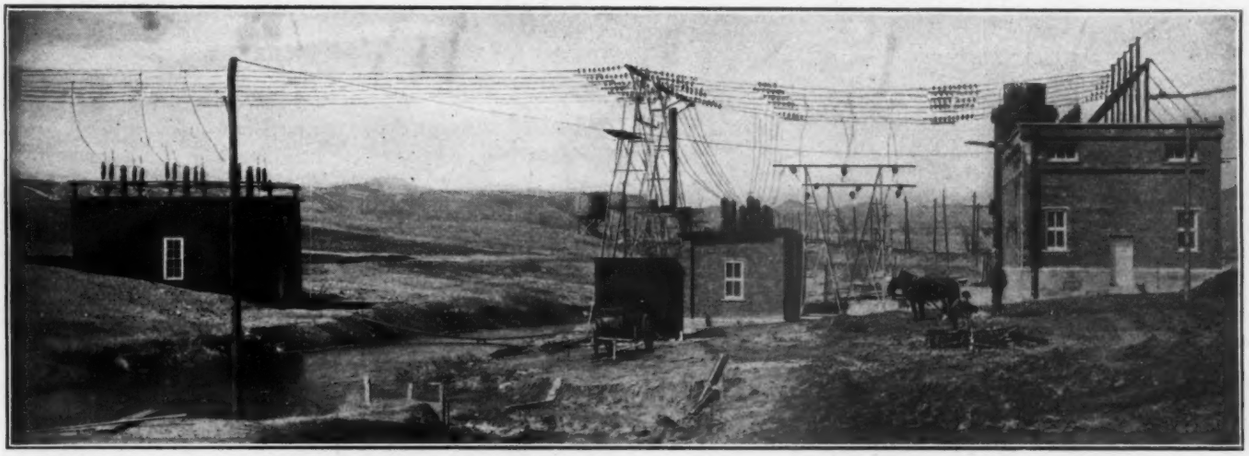


Fig. 1—Outdoor Busbars and Switch Houses, Denver Substation.

Another view of the general arrangement is given in Fig. 2, where the transformer repair shop is shown at the left. A track leads out of the transformer room in the substation proper to the transformer repair shop. The high portion of the repair shop is to permit the hoisting out of transformer coils.

There are no 100,000-volt busbars or switching apparatus in the substation building proper. Each of the two incoming 100,000-volt lines has a separate switch house to itself, in which is an oil switch. A diagram of the 100,000-volt connections of the Denver substation is given in Fig. 3. Each incoming high-tension line first passes through disconnecting switches, which are arranged out doors, being supported by and shunted around suspension porcelain insulators of the same type as used on the high-tension line. Each insulator consists of four disks 10.25 in. in diameter, arranged in series. From the dis-

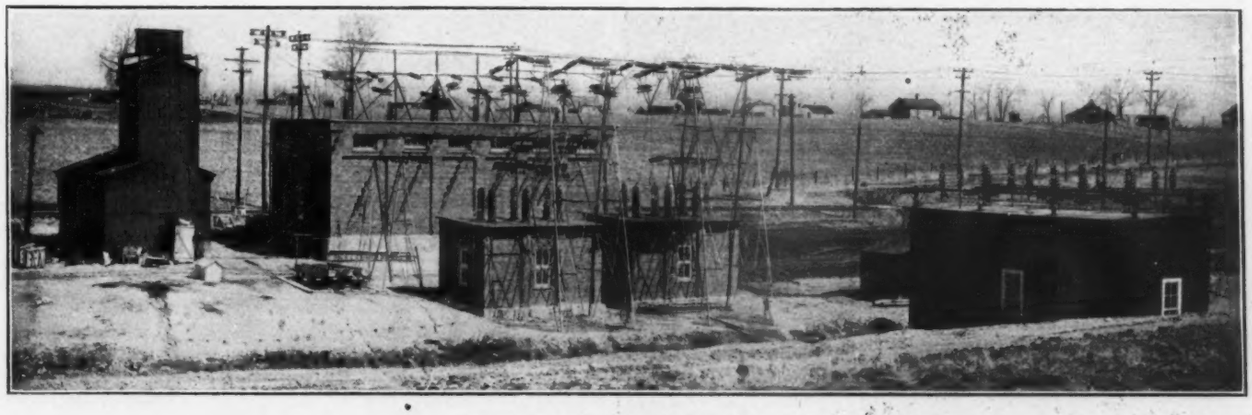


Fig. 2—Denver Substation Buildings.

connecting switches each line passes down to the oil switch in the switchhouse. From the oil switch the lines go up to a second set of disconnecting switches and then to the busbars. These bars are divided in the middle by disconnecting switches. From the busbars leads pass through disconnecting switches to the transformers in the substation. At present

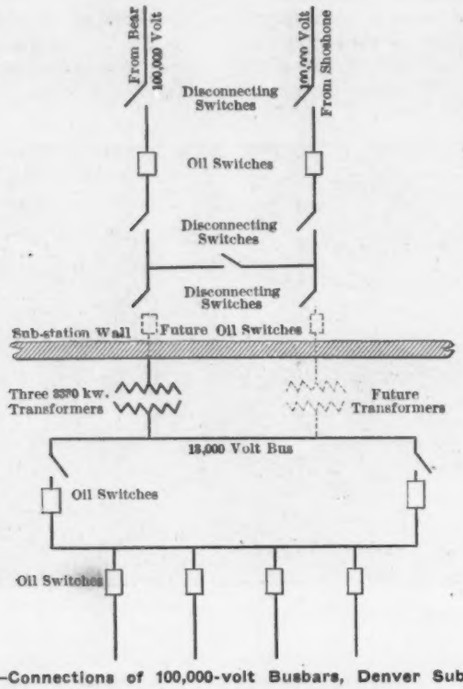


Fig. 3—Connections of 100,000-volt Busbars, Denver Substation.

there is only one set of transformers in use. The connections of the future transformer set are indicated by dotted lines on Fig. 3. The busbars are suspended below the leads, which pass directly from the switches to the transformers, and thus serve to connect together the incoming lines, when the disconnecting switch at the middle of the busbars is closed. It is

Fig. 4—Transformers in Denver Substation.

intended in the future to put oil switches between the busbars and the transformers at the point indicated in Fig. 3. Until the second bank of transformers is added this is not necessary.

Fig. 4, which shows the bank of step-down transformers in the substation indicates how little 100,000-volt wiring there is in the substation. In Fig. 5 is shown a sectional elevation of the Denver substation, indicating the general arrangement of the apparatus. A plan of this substation is given in Fig. 6. The three 100,000-volt wires come through the roof in the roof bushing directly over the transformers, and pass straight down to the transformer terminals. Besides this, the only 100,000-volt wiring necessary in the substation is the connection from one end of the transformer bank to the other. These bushings were described in the issue for June 23, 1910, in the article describing the Glenwood generating station. They are from 9 to 11 ft. long, according to local requirements, and about 5 ft. extends above the roof. The conductor is held in the middle of a long fiber tube. The space around the conductor and the tube is filled with a thick insulating compound. The diameter of the tube is about 8 in. The top of the tube is protected with porcelain disk insulators, five in number, and by a piece of sewer tile, which extends from the lowest insulator to the roof. The entrance bushings were at first put into a hole cut through the concrete roof. A number of failures convinced the company that the contact of the bushings with

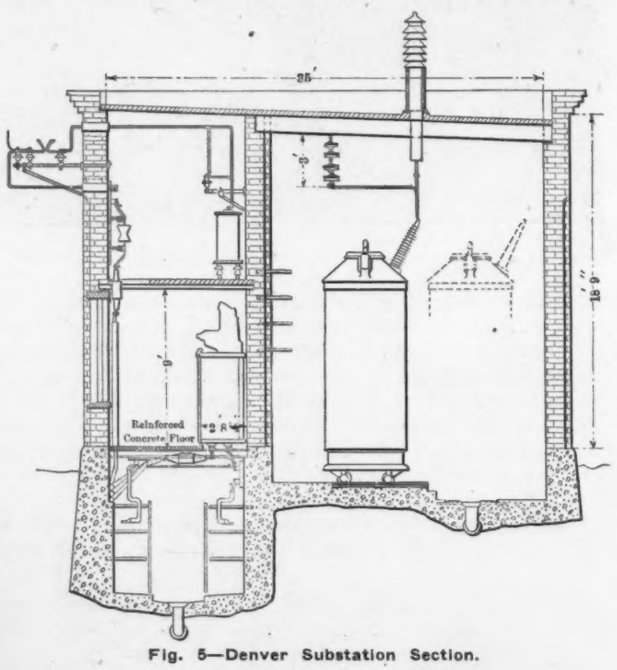


Fig. 5—Denver Substation Section.

the concrete roof and its reinforcements put an undue strain on the bushing, and the roof was, therefore, cut away for an area of about two feet square and the space thus made was roofed in with lumber which had been treated with paraffine. No further trouble was experienced. The transformer leads inside the substation consist of brass tubing of the same size as 1-in. extra heavy iron pipe.

To avoid the difficulty, complication and expense of insulating series transformers for the overload relay circuits in connection with the 100,000-volt oil switches in the substations, the coils which actuate the relays are placed directly in the 100,000-volt line as they lead into the switches. The armatures of these relays are connected mechanically with the low-tension make-and-break contact in the Denver substation, and in the Dillon substation and others; where switch operation is by hand they operate a mechanical trip instead of closing a direct-current control circuit. This mechanical connection with the relay contacts or with the mechanical trip is made through a long wooden rod boiled in paraffine. It is found that a length of from 10 to 12 ft. is sufficient for insulating purposes.

It will be seen that the transformer room is separate from everything else in the substation. It is isolated by a 13-in. wall from the switching apparatus and 13,000-volt busbars which occupy the other part of the station. Each transformer

may be rolled onto a small truck, so that it can be wheeled out into the transformer repair shop as before mentioned. The 13,000-volt busbars are in the basement of the operating department of the substation. Above this basement is a room

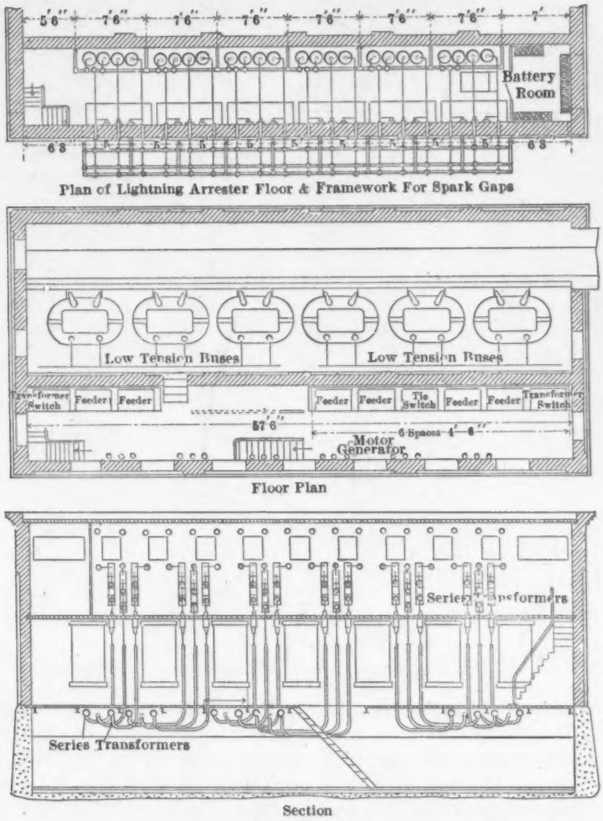


Fig. 6—Denver Substation Plans.

for the 13,000-volt oil switches, and the control switchboard. The third floor is a gallery, which is occupied by lightning arresters, and miscellaneous apparatus. Fig. 7 is a view in the switch and control board room of the substation.

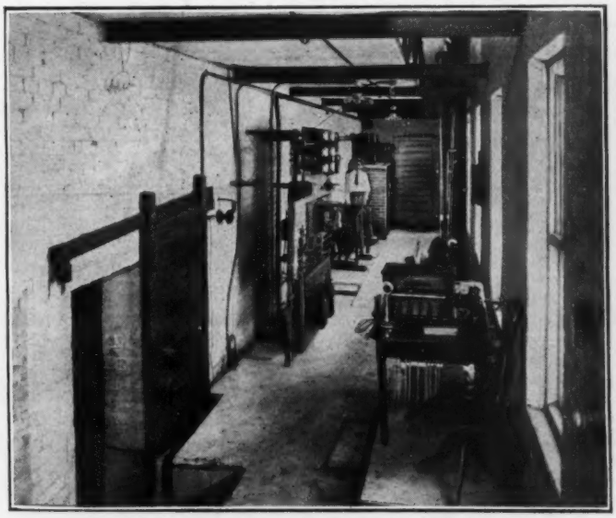


Fig. 7—Operating and Switchroom, Denver Substation.

Aluminum cell arresters are used both on the 13,000-volt and the 100,000-volt lines entering the substation. On the 13,000-volt line, horn gaps are placed just outside the substation, as shown in Fig. 5.

A small storage battery, consisting of 5 cells, made by the Electric Storage Battery Company, is installed for operating the switch motors at the substation. To charge the battery, a 10-hp induction motor connected to a 6.5-kw generator is used.

In the basement below the operating room the busbar compartments are made of asbestos composition, supported by thin steel sections.

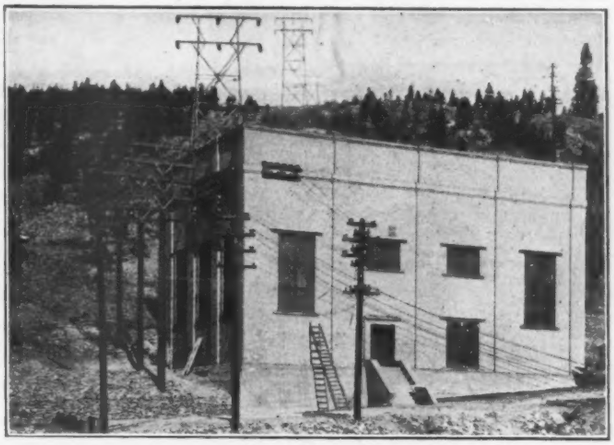


Fig. 8—Exterior Leadville Substation.

The substation building is of plain brick, with concrete reinforced slab roof. The reinforcement is with "Hy-Rib." The eye beams supporting these slabs are fireproofed by concrete. The substation and switch houses are as fireproof as possible, having absolutely no wood in their construction except the doors, the buildings being of brick with concrete roof, metal window frames, sash, etc.

It is interesting to note that the total cost of all buildings, etc., connected with the substation—that is, all cost except electrical apparatus—did not exceed $10,000. As the substation has a rating of 15,000 kw, this, of course, figures out about

Fig. 9—Interior Leadville Substation.

$0.66 per kw, which will compare very favorably with the costs of other substations.

LEADVILLE SUBSTATION.

The first substation built by this company was at Leadville. This substation is near a steam-turbine generating plant, which

acts as an auxiliary and is controlled by this company. The rating of this substation is 4500 kw in the shape of three 1500-kw transformers. Fig. 8 shows the exterior appearance of the Leadville substation, with the incoming 100,000-volt lines and the outgoing 6600-volt distributing lines for Leadville and the nearby mining district. It will be noticed that there are two three-phase incoming lines. . This is due to the fact that the Leadville substation is a little to one side of the main transmission line from Shoshone near Glenwood to Denver. The transmission lines, therefore, have to make a loop into the Leadville substation in order that the Leadville substation may be used as a switching station for dividing the transmission line in emergency.

A diagram of the general scheme of switching and busbars of the leadville substation is given in Fig. 10. The incoming 100,000-volt line from Glenwood and the outgoing 100,000-volt line to Denver are equipped with oil switches. At this substation the oil switches for 100,000 volts are located in the substation building. Fig. 9 is a view of the interior of the substation, showing the transformers, high-tension switches and some of the wiring. The two high-tension lines lead into a common busbar, and from the busbar a totalizing oil switch connects to the transformer busbars. From the transformer busbars, the three 1500-kw, three-phase transformers receive energy. The transformers reduce the e.m.f. from 100,000 volts to 6600 volts, the latter e.m.f. being the distribution voltage for the city of Leadville and surrounding mines. Between the 6600-volt busbars and the transformers is a totalizing oil switch. From the 6600-volt busbars, the lighting feeders are taken off, the Leadville feeders being equipped with voltage regulators. There is also one incoming line to supply energy to the busbars from the steam turbine plant nearby.

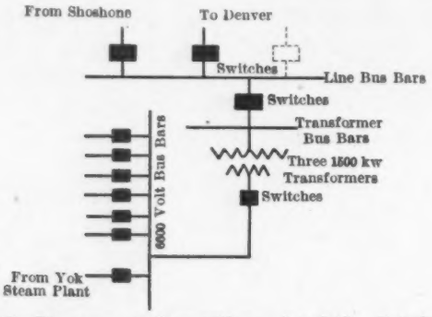


Fig. 10—Diagram of Connections, Leadville Substation.

The busbars in the substation for the 100,000-volt lines consists of three 0.75-in. brass tubes. In later construction 1-in. tubes have been used for this purpose. For handling transformers in the substation, the arrangement is such that each transformer can be moved from its position by being rolled back on a pair of rails, after which it can be picked up by an overhead trolley supported by an eye-beam resting on latticed columns and carried to the transformer pit, into which it can be lowered and the coils hoisted out. The oil switches in this station are supported on steel trestles.

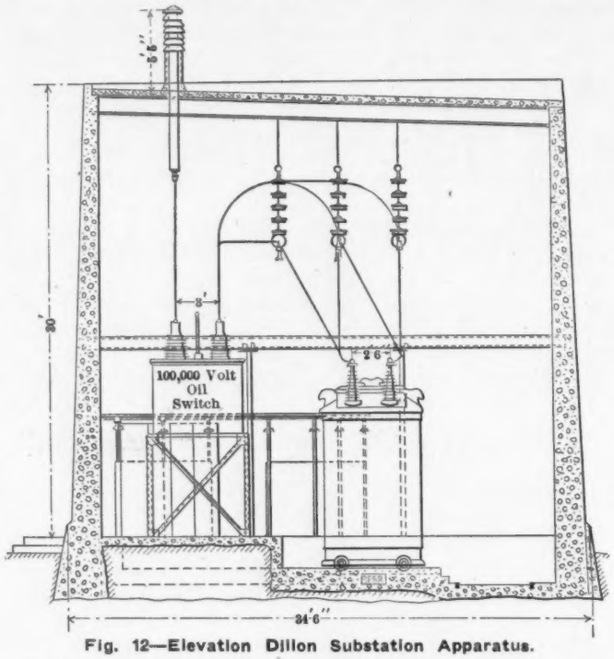


Fig. 12—Elevation Dillon Substation Apparatus.

This is the only substation of the company where porcelain wall bushings are used for the incoming high-tension line. At the other substations, the roof bushings later developed are employed. The wall bushings are of built up porcelain, and set in wood frames 4 ft. square. The frames are of poplar boiled in paraffine. The substation building, which is of brick laid in cement mortar, is covered by a 3.5-in. concrete slab roof with rod and expanded metal reinforcement.

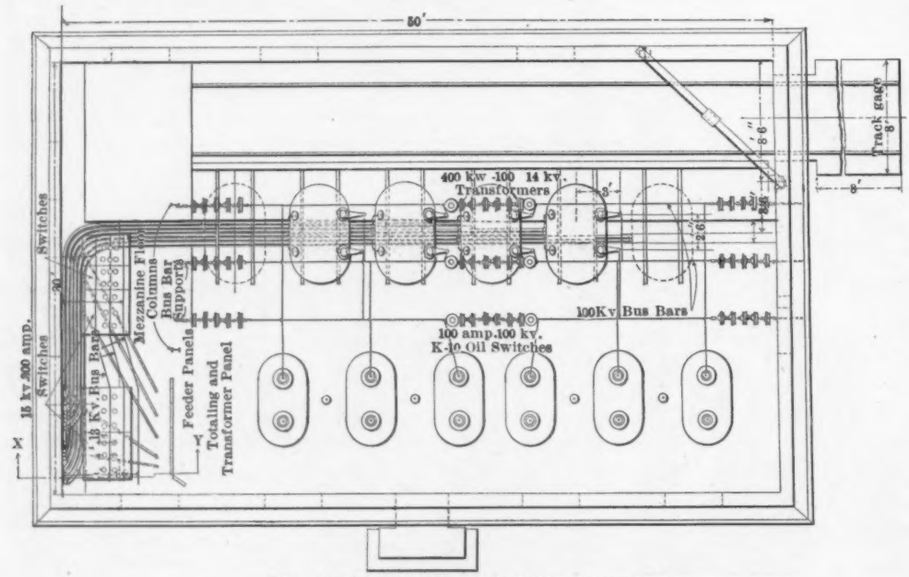


Fig. 11—Plan Dillon Substation Apparatus.

DILLON SUBSTATION.

The Dillon substation was built subsequently to the Denver substation, for supplying energy to the mines in Summit County. In the case of this station the 100,000-volt busbars were placed inside the building on account of the severe climatic conditions. The building has monolithic concrete walls 24 in. thick at the bottom and 12 in. thick at the top. Fig. 12 is a sectional elevation of the Dillon substation, showing the arrangement of apparatus. Fig. 11 is a plan view of the same substation. The roof is a concrete slab 4 in. thick with steel rod reinforcement. It is supported on I-beams 8 ft. apart. No crane is used in this substation, but each transformer is on wheels, and can be run onto a car or transfer table, which is

12 in. high from the wheel to the rails on the top of the car. The transfer table runs the transformer out of the building if necessary. The conduit duct shown under the transformers in Fig. 12 is for the 13,000-volt secondaries. There are two pairs of transformers in this substation, each pair being connected in open delta. The secondary distribution in the mining district is at 13,000 volts.

There are three 13,000-volt feeder panels with a provision

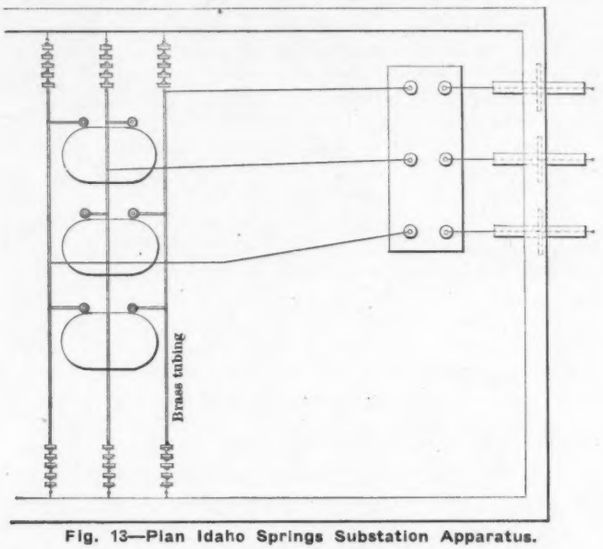


Fig. 13—Plan Idaho Springs Substation Apparatus.

for a fourth. The high-tension busbars in the substation consist of brass pipe of the same size as 1-in. extra-heavy iron pipe. The substation is on the Blue River and cooling water is obtained out of a shallow well with a 2-in. vertical shaft centrifugal pump furnished by the American Well Works. Each transformer is rated at 400-kw each, and there is provision in this substation for six such transformers as seen on the plan in Fig. 11.

IDAHO SPRINGS SUBSTATION.

A plan of the Idaho Springs substation is shown in Fig. 13. This substation is in one end of the building owned by the United Hydro-Electric Company, which distributes electric energy in the mining districts around Idaho Springs and Georgetown. This latter company has several plants and substations, and has made arrangements with the Central Colo-

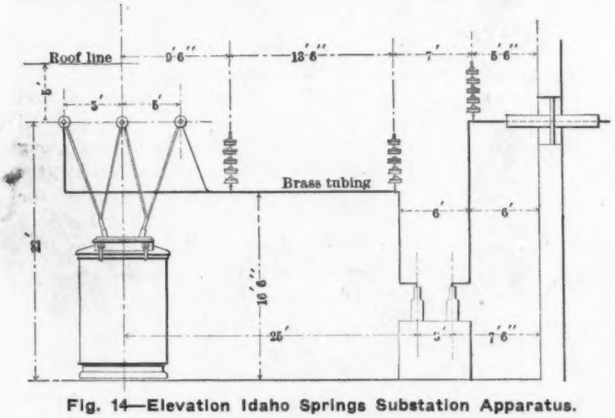


Fig. 14—Elevation Idaho Springs Substation Apparatus.

rado Power Company for energy in addition to that which it is able to supply at present from its own stations.

At this substation the 100,000-volt lines enter through bushings of fiber tube placed in the walls. These bushings are in wood frames 3 in. thick and 4 ft. square. The bushings are 12 in. in diameter and 8 ft. long, and were furnished by the American Conduit Company. A 100,000-volt oil switch is inserted between the incoming lines and the transformer busbars.

There are in this substation three 750-kw transformers which reduce the e.m.f. to 13,000 volts. At this latter voltage, energy is fed into the United Hydro-Electric Company's lines.

ELECTRIC PUMPING FOR IRRIGATION.

By Alton D. Adams.

The arid and semi-arid regions of the United States comprise some 600 million acres, and it is estimated that 100 million acres of this area can be brought under agriculture by the several systems of irrigation. For another great area on the High Plains the possible supply of water is not great enough to support general agriculture, but this land can be made available for stock raising by pumping the ground water at points near enough together for watering cattle.

Besides irrigation in the arid regions, it is practiced in the rain belt for certain crops, as in the rice fields of Southwestern Louisiana and Texas. Reclamation of lowlands has received but slight attention in the United States, but it is estimated that along the lower Mississippi River alone there are 20 millions acres of land that would yield a bale of cotton per acre, if relieved of surplus water by levees and pumping.

The United States census of 1902 shows that 10,000,000 acres of land were then being irrigated. Since that date the extension of irrigation under the Reclamation Act and the Carey Act has been much more rapid than before, due to the activity of the Reclamation Service and of private corporations, so that the present year will probably see the above figure for irrigation doubled.

Water supply by gravity alone to irrigated land is desirable where practicable, but much good land is quite above the reach of gravity flow without the aid of pumps.

Even in Egypt, where so much has been done for irrigation by the great dams of the Nile, about 5000 hp was used for irrigation above the canals several years ago, and new projects were underway. One of these was the irrigation of 20,000 acres on the Kamambas plain by pumping water to the height of 65 ft. above the summer level of the Nile.

As the cost of energy for pumping has been a great retarding factor in irrigation above the canals, the supply of cheap hydroelectric energy that is available day and night will rapidly extend the application of pumps.

In a number of localities in the United States large areas are now irrigated by pumped water, or pumping systems for their irrigation are under construction. The Rice Belt of Louisiana and Texas was irrigated with pumped water to the extent of 750,000 acres, in 1904, and the water was lifted from 10 to 65 ft. from the rivers to the canals.

Southern California was one of the first sections to extensively adopt electric pumping in irrigation, and according to the census of 1900 there were 152,506 acres irrigated from wells in that State. Eight years ago there were 1500 pumping plants raising water from wells for irrigation in the Santa Clara Valley alone. A record of more than seventy wells about Pasadena, Cal., shows depths to water of from 10 to about 100 ft. In Tulare and Kern counties a record of 25 wells shows depths of up to 87 ft. with 12 wells of 50 ft. and more, and only two flowing wells. Besides lifting the water to the surface of the ground the pumps generally force it to greater elevations for distribution, sometimes more than 100 ft. above the mouth of the well.

In the narrow valleys of the rivers that have cut through the High Plains of Kansas, Nebraska and other States of the semi-arid belt, the ground water may be found within a score of feet of the surface, but on the High Plains themselves the depths are much greater and reach 300 ft. At Garden, Kansas, in the Arkansas valley, there were 102 wells pumped for irrigation from depths of about 20 ft. a decade ago in an area of one square mile. In the Garden City irrigation project just completed to water 10,600 acres of the

uplands, the pumps are located in the valley and are operated by electricity for a supply to the higher levels.

On the Flathead project in Montana water is to be pumped from the Flathead River for the irrigation of 3000 acres, and on the Fort Peck project of the same State 12,000 acres are to be irrigated by lifting a part of the water 12 ft. and the remainder 20 ft. The Buford, North Dakota, project provides for the irrigation of 12,500 acres with water pumped from 30 ft. to 50 ft. from the Missouri River to low and high-level canals by electric power that is transmitted 28 miles. Water pumped from the Missouri is also the means of irrigation in the Washburn project of the last-named state. The Williston, North Dakota, project involves the electric pumping of water from the Missouri River to three different levels for 12,000 acres of land.

In the Minidoka project of Idaho the area to be irrigated by electric pumping from the Snake River is 49,906 acres, and hydroelectric energy is being used for the completed part of this work. Plans for the Post Falls irrigation project call for electrically driven pumps of 300 gal. per second to lift water from Hayden Lake to an elevation whence it can be distributed to 3500 acres of land by gravity.

Electric pumps in the irrigated section about Boulder and Greely, Col., lift the water from 20 ft. to 30 ft. The Yuma, Ariz., project involves electric pumping for the irrigation of 6,000 acres. In the Salt River Valley 50,000 acres are to be irrigated by electric pumping from wells, and energy for this work will be generated by hydroelectric plants at and below the Roosevelt dam. Near Mercedes, Tex., 200,000 acres are to be irrigated with water raised from the Rio Grande river, and electric pumps with capacity of 1000 gal. of water per second are now doing a part of this work.

It is plain from the above that a large part of irrigation can only be done by pumping the water, and as this pumping forms a 12 to 24-hour load during the season of small lighting, it is particularly attractive to hydroelectric plants.

These instances illustrate three ways that electric pumping is applied to irrigation. In one class of projects the water is pumped from wells on the land where it is to be used and forced to the required height for distribution, as is practiced on a great scale in California. A variation of this class of project occurs where the wells are located near a river to intercept the underflow and the water is pumped to the uplands on either side, as is the case with the above development along the Arkansas River in Kansas. Where the water for irrigation is lifted directly from the river to the level of the irrigated land another class of project is presented, as in the above North Dakota system, where electric pumps raise water from the Missouri River. Still a third form of project is presented where irrigating canals carry the water of a river as far onto the uplands as possible, and then electric pumps are employed to lift the water to higher levels where it will not flow by gravity. This system of irrigation is of growing importance and is illustrated by the above Idaho project where hydroelectric power will operate pumps to lift water from canals to irrigate some 49,906 acres above the canal level, while 82,125 acres below these canals are irrigated by gravity flow.

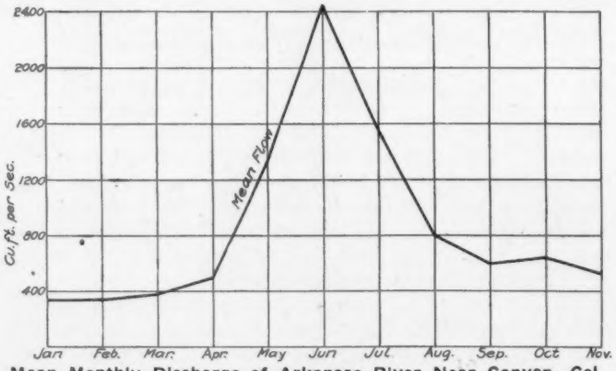
The total height that the water must be raised in each of these several methods of irrigation varies widely on different projects, and of course bears directly on the power and energy required for irrigation. The energy required for irrigation during a season depends, among other things, upon the duty of water, that is, the quantity required per acre, and the maximum rate per second at which it must be supplied fixes the power. The depth that all the water required for irrigation would form on the land if the supply for the season were collected there at one time varies from less than 1 ft. to more than 5 ft., but the more common figures are between 2 ft. and 3 ft. The quantity of water required to cover one acre 1 ft. deep, or one acre-ft., equal to 43,560 cu. ft., and at 62.4 lb. per cubic foot the weight of 1 acre-ft. of water is 2,718,144 lb. If the combined efficiency of the motor and pump for this work is 60 per cent, the energy that must be delivered to the motor to lift an acre-foot of water through 1 ft. is 1.70 kw-hours.

The season or period of irrigation varies from less than two months to 12 months in each year according to the location of and the crops raised on the irrigated land, but the more common periods are three to six months long. Irrigation during the entire year is practiced in southern California and Arizona with some crops. In States further north the period of irrigation is usually no more than six months, and four months is nearer the limit in Utah, Colorado, Wyoming and Montana. To any particular piece of land the water may be delivered anywhere from less than 1000 hours to more than 2000 hours during the irrigation period, according to the kind of crop and other conditions, but as different parts of the irrigated land are watered in rotation there is a continuous demand for energy at the pumps.

On the basis of 2.5 ft. depth of water during the period of irrigation, there will be required 4.25 kw-hours per acre for each foot that the water is lifted.

An electric pumping system in the valley of the Arkansas River, Kansas, had 575 hp of motors connected to the pumps and irrigated 3285 acres last year, an average of 5.7 acres per horse-power. In North Dakota a 500-kw plant was employed for the irrigation of 816 acres, or 1.63 acres per kilowatt, and could not provide water enough. The period of irrigation was a little less than three months in this last instance, and this short season accounts in part for the relatively large power required per acre irrigated.

The area of 18,000 acres irrigated by a single electric pumping system in California amounts to 4.8 acres per motor horse-



Mean Monthly Discharge of Arkansas River Near Canyon, Col., for 1906.

power on an average. Pumping is done from wells in this instance, and the heads of water lifted vary up to several hundred feet, but are less than 100 ft. on most of the land.

Where power for pumping is developed by water the time relation of greatest river discharge and of maximum demand for irrigation is important, and this relation varies somewhat in different parts of the arid regions because of the several lengths of the irrigation periods. In southern California, along the Santa Ana River, water is used for irrigation during the entire year, and the demand is at its maximum most of the time from February to September, inclusive. Further north in the same State, in Tulare County, the greatest demand for irrigation runs from May to September. In Utah, irrigation begins in April, is at its maximum during much of June and July, and then declines rapidly to the end of September, as indicated by records for the vicinity of Salt Lake City.

Near Lamar, Col., irrigation begins in March, is at a maximum in June and July, and ends with September. About Gothenburg, Neb., the demand for water in irrigation begins and quickly goes to near the maximum in June, continues at the highest rate in July and is still large during August and September. The largest system of the State, about Wheatland, Wyo., supplies water for irrigation mainly during June, July and the first week of August. A somewhat similar demand for water occurs near Bozeman, Mont., but here irrigation begins in the last third of June and runs to the middle of September, the greatest volume of water being used in July. Irrigation about Boise, Idaho, begins not later than the first of May, and the de-

mand for water continues near the maximum during June, July, August and September.

The irrigation periods above indicated correspond to the wants of the more important crops in the several localities, and the power, of course, goes up with the demand for water where the supply is pumped.

Over almost the entire arid and semi-arid regions of the United States the rivers have their sources in the mountains, and the greater part of their flow is derived from the melting snows. Under these conditions the maximum rate of discharge usually occurs in June, and there follows a gradual decrease of the volume from that month until about October. In the following March or April the volume of such a river again begins to rise.

The Arkansas River is typical of the arid regions, rising as it does in Tennessee Pass at an altitude of 10,400 ft. and flowing 1497 miles across Colorado, Kansas, Oklahoma and Arkansas to the Mississippi.

With the Arkansas as a typical river of the arid region, it thus appears that the maximum power of a hydroelectric plant can be developed at just the time that it is wanted in irrigation, and it is improbable that this maximum power can be put to any use except this pumping.

TEST OF A 170-HP OIL ENGINE.

By H. P. Macdonald.

The oil engine from the operation of which the data which follow were obtained is a two-cylinder, 170-hp, type F. H. engine manufactured by the De La Vergne Machine Company, of New York, and furnishing energy for the foundry and shops of The Snead & Company Iron Works, of Jersey City, N. J. It is the invention of Mr. A. Franchetti, and units the high efficiency of the Diesel engine with the simplicity and accessibility of the Hornsby-Ackroyd. The engine operates on the four-cycle principle. On the compression stroke the air charge is compressed to about 350 lb. A few degrees before the dead point the oil charge is injected across the cylinder heads into vaporizers consisting of hollow hemispherical castings bolted to the sides of the cylinder heads and opening into them, these vaporizers being heated with a blast lamp before starting up the engine. The oil is ignited by the heat of compression combined with that of the vaporizers, which in consequence do not have to be raised to a high temperature. The air used for spraying the oil into the vaporizers is furnished by two two-stage compressors, bolted to the main engine cylinders and operated from eccentrics on the main shaft. Four steel tanks act as receivers between the high and low stage of these compressors, the pressure in them being about 100 lb. and the final pressure 500 lb. to 600 lb. The entire oil charge is admitted at once and the explosive pressure runs from 400 lb. to 450 lb. The oil is pumped from the storage tank to a small standpipe by a belted gear pump; single-acting plunger pumps take the oil from the standpipe and force it up to the spray valves. These pumps are operated by cams on the valve shafts striking against swinging rods, which in turn transmit the motion through rollers, hung from a Hartung governor, to bell-crank levers connected to the plungers of the pumps, regulation being obtained through the governor raising or lowering the rollers, thereby shortening or lengthening the stroke of the pumps.

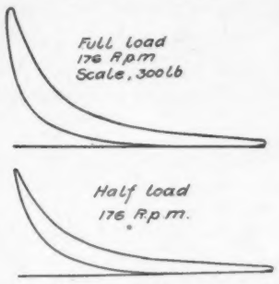


Fig. 2—Indicator Cards of Oil Engine.

The engine is directly connected to a 125-kw generator operating at 525 volts, the output being measured by a watt-hour meter. The cooling water runs into a tank under the floor, and from there is pumped by a 4-in. x 6-in. Gould triplex pump, belted from the engine coupling, to the cooling tower on the roof of the building.

An auxiliary compressor driven by a Michigan gas engine using city gas is provided to supply compressed air used in starting up the engine for the first time, and as a standby in case the pressure in the storage tanks is lost between runs. The plant operates two air compressors driven by 35-hp and 45-hp motors in addition to machine shop and foundry loads, a total of 350 hp connected. The compressors are supplied with relief devices, and the load varies from 25 to 90 per cent of the rating of the engine. The compressed air stored in the tanks is used to start the engine, the pressure being raised to 140 lb. after the load is off before shutting down the engine at night.

The engines are started a few minutes before 7 a. m., and run until 5 p. m. with no stop at noon. One attendant has charge of the engines and air compressors, and has time to do repair work on small tools for the shops. He has an assistant for an hour each morning in oiling and starting up the plant. The fuel used is a residual after gasoline, naphtha, kerosene, etc., are extracted from crude oil, and has the characteristics as shown in table on following page, as determined by Mr. Henry C. Sherman, Ph.D., of Columbia University.

The data on next page covers the results of operation for the

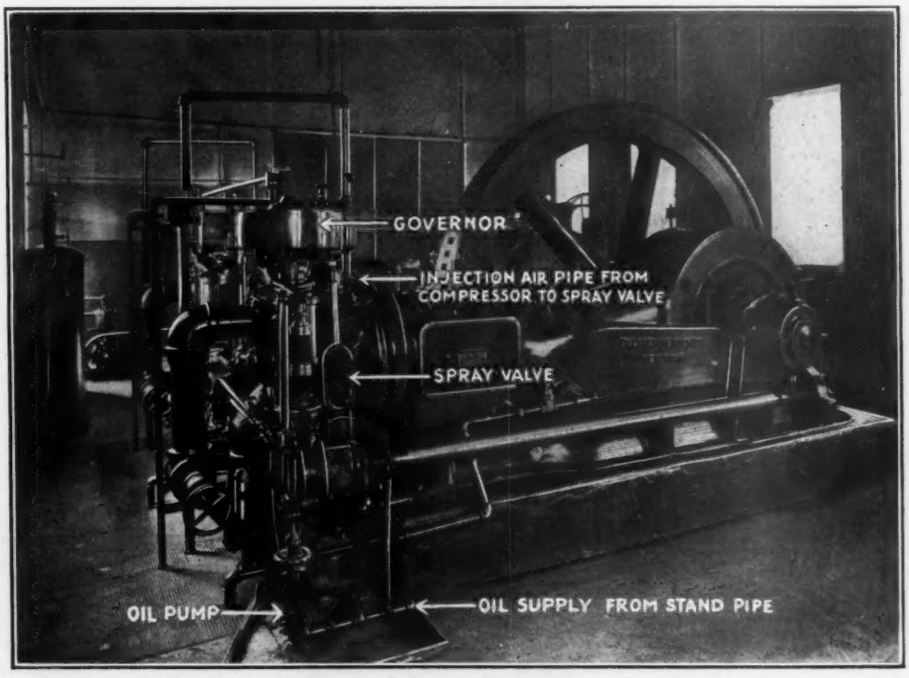


Fig. 1—170-HP Oil Engine.

months of February, March and April, 1910. The engine was run part of December and January, but the load was so light, due to stock taking in the shops, as to make the results of little value.

TABLE I.—PROPERTIES OF FUEL OIL.

Specific gravity	0.8815 at 60° F.
" " Baume	25.8° " " "
Flash point	201° F.
Burning point	309° F.
Calorific value	19,530 pound = Fahrenheit units

Cooling water was not measured, the amount required to replace evaporation being negligible. Engine oil is filtered and re-used; wipers are washed and re-used.

The operation of the engine is almost silent, though only a single muffler pot is used for each cylinder. The combustion is so perfect that at steady loads the exhaust is invisible, and the cylinder and vaporizer are free from carbon deposits, never having had to be cleaned. The engine can be run continuously on 24 hours a day service.

If necessary, the oil supply to either cylinder can be shut off, the valves blocked open and the engine run on a single cylinder. This was done one day in February, the electric load on one cylinder running up to 100 hp. Highly skilled attendance is not required as any bright mechanic can quickly learn to operate such a plant.

TABLE II.—OPERATING COSTS.

Month	February		March		April		Total	
	Gallons	Cost	Gallons	Cost	Gallons	Cost	Gallons	Cost
Fuel oil, @$2.25 gal.	1511	$34.00	1452	$32.71	1479	$33.28	4442	$99.99
Cylinder oil, @23.6 cts. gal.	29.5	7.25	30	7.08	23	5.42	82.5	19.75
Engine oil, 21.6 cts. gal.	26	5.65	8	1.73	13	2.81	47	10.19
Gear oil, @30 cts. gal.	5	1.50	7	2.10	5	1.50	17	5.10
Cup grease, @10 cts. lb.	5	0.50	5	0.50	5	0.50	15	1.50
Waste, @4½ cts. lb.	11	0.47	....	.....	....	.....	11	0.47
Wipers, @13 cts. lb.	19	2.47	9	1.17	....	.....	28	3.64
Kerosene, @11 cts. gal.	15	1.65	25	2.75	25	2.75	65	7.15
City gas, @ 85 cts. 1000 ft., power.	....	.....	800	0.68	....	.....	800	0.68
City gas, @ 85 cts. 1000 ft., light.	2300	2.04	235	0.20	400	0.36	2935	2.60
Attendance	....	47.24	....	59.13	....	56.42	....	162.79
Total	....	$102.77	....	$108.05	....	$103.04	....	$313.86
Hours operated	220		270		264		754	
Kw-hrs produced	12,900		15,270		14,970		43,140	
Average load	58.5 kw or 51%		56.7 kw or 49.2%		56.6 kw or 49.2%		57.2 kw or 49.7%	
Cost per kw-hr.	0.795 ct.		0.71 ct.		0.687 ct.		0.727 ct.	
Pounds of oil per hp-hr.	.579		.469		.486		.507	
Thermal efficiency (oil of 19,530 units)	22.6%		28.0%		27.0%		25.8%	

The engine is the first one of this type sold by the makers and has not been running long enough to obtain data, which permit an estimate of the repairs; but judging from its massive construction, ample bearings, thorough lubrication and the entire absence of carbon deposits, the maintenance charges should be very low.

The cost of such a plant is about equal to that of a high-class steam plant, the greater cost of the engine and slow-speed generator being practically balanced by the cost of larger buildings, boilers, stacks, etc., of the steam plant; the cost of the oil-engine plant is less than that of a first-class producer-gas plant, the engine cost being about the same and the expense of the producer and building to house the producer equipment being additional.

The oil engine requires less attendance than either the steam or producer plant, no fireman being required. The fuel economy is far greater than that of the steam plant, and exceeds that of the producer plant. Assuming the specific fuel consumption of the producer gas engine plant as 1 lb. of coal per hp-hour, coal costing $3.50 per long ton, the fuel costs are respectively 0.135 cent and 0.156 cent, taking the consumption of the oil engine at 0.44 lb. of oil per hp-hour at full load as shown on test—the difference being even greater at light loads. In addition there is no expense for water in the oil engine plant, while in the producer plant the scrubbing water is wasted.

AN ELECTRIC SLIP METER.

By Frank W. Springer.

A convenient form of slip meter for use with induction motors is indicated in Figs. 1 and 2. The instrument consists of a shaft S_2 connected to a small synchronous motor and a shaft S_1, in line with S_2, geared to the induction motor being tested, so that the two disks M and N, mounted on the above two shafts respectively, will rotate at the same speed and in the same direction when the induction motor is run at exact synchronism.

One-half of the metal disk N is cut away and filled with fiber, so that the pin brush P has no tendency to jump when the disk N runs slower than M.

For each revolution that the synchronous motor disk M gains on the disk N the miniature tungsten lamp L will flash and go out once. The gearing is such that when the synchronous motor is running as an eight-pole machine each flash represents a slip of four cycles. When time and frequency are known, the slip in per cent may be readily calculated.

The synchronous motor part of the instrument, Fig. 1, is a General Electric type of frequency meter, which consists of a synchronous motor and revolution counter so that by means of a stop-watch one can measure both the frequency and the slip simultaneously with considerable accuracy in 30-second runs. It is, of course, necessary to start and stop counting at the beginning, or end, of a flash of the tungsten lamp.

The following details of construction may be worthy of notice: The faces of the disks M and N are set perfectly parallel with each other in order that a very slight pressure by the piano wire spring D suffices to hold the brush always in contact with the disk N. A couple of small dry cells supply current for the miniature tungsten lamp, so that there is no undue wear of the brush due either to sparking or friction, such as would be caused by high electrical and mechanical pressure.

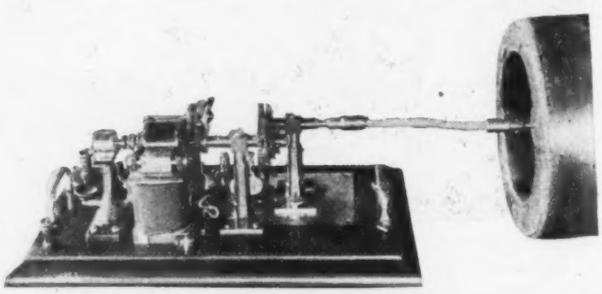


Fig. 1—General View of Slip Meter.

The tungsten lamp is shown mounted on the instrument, but it may readily be placed wherever it can be observed most conveniently. A ratchet counter, sounder, etc., might be used in-

stead of, or with, the tungsten lamp, but are not recommended for constant use on account of sparking at the brush.

The flexible shaft shown in Fig. 1 is made of a 5-in. length of sash cord. The sash cord is pinned into one end of each of two sleeves. One sleeve is slotted to be driven by a suitable

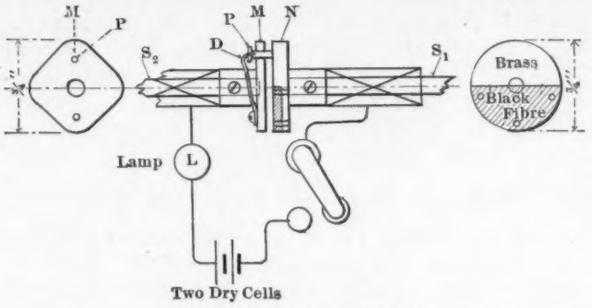


Fig. 2—Details of Slip Meter.

pin on the gear shaft. This slot takes care of the end play of the induction motor. The other sleeve is fastened to the induction motor shaft by a pin consisting of a piece of soft wire (fuse metal) so that in case anything gets into the gearing the instrument will instantly clear itself from the driving shaft.

TRANSFORMERS IN THREE-PHASE CIRCUITS

Current and Voltage Relations in Open-Delta Connections.

By R. G. Lafite.

The relations of currents and electromotive forces in the different phases of open-delta connections are often puzzling, and it is with the hope of clearing up some of the difficult points that the following article has been written. For simplicity the power-factor of the load is assumed to be 100.

CURRENT RELATIONS.

Fig. 1 represents the open delta of, say, a bank of transformers, the connection from *C* to *A* being left open. Consider the rotation of the phases in the circuit, beginning at the instant when the current at *A* is a maximum in, say, the positive direction. That is, the wave *A* in Fig. 2 is above the zero line and has reached the maximum value; the clockwise direction of the arrow in Fig. 1 indicating a positive value. If *A* is a positive maximum, *B* and *C* must both be negative and will both have the value of 1, if it be assumed that *A* has a maximum value of 2; the arrows on Fig. 1 showing the direction of currents in *B* and *C* must therefore point opposite to that in *A*. The current due to the e.m.f. in *C* which, if the delta were closed, would flow from *E* to *D*, cannot do so when the delta is open, since there is no circuit; but the difference of potential from *F* to *D*, instead of sending current in a counter clockwise direction, from *F* to *D* through the circuit *C*, must send it clockwise through *A* and *B*, so that the current *C* will no longer oppose *A*, but flows in the same direction with it; at that instant 1 (Fig. 2) the winding *A* will carry the sum of the currents *A* and *C* flowing through it, or 2 + 1. However, current *B* has the same value (1) as *C*, and since they flow through *B* in opposite directions, they neutralize each other and current through *B* is zero. At instant 2 (Fig. 2) *C* is a maximum in the negative direction, while *A* and *B* are both positive; as, however, current *C* must flow not through circuit *C*, but in opposite direction through *A* and *B*, it will be clockwise like them, and the total

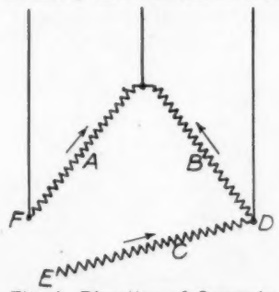


Fig. 1—Direction of Currents in Open Delta Connections.

instantaneous current will be 2 + 1 = 3, in both *A* and *B*. Thus, by following the instants of maximum current values in Fig. 2, such as 1, 2, 3, 4, 5, 6, etc., one can arrive at the current flowing through the two sides of the delta at all of these instants successively, and by taking a few intermediate points one can

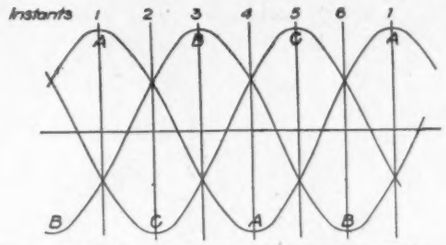


Fig. 2—Diagram of Currents in Three-Phase Circuit.

obtain the exact form of the wave; the following tabulation shows six instantaneous values, first for closed, then for open delta:

Instant	Closed Delta.			Open Delta.	
	A.	*B.*	*C.*	*A.* and	*B.*
1	+2.	−1.	−1.	+3.	0.
2	+1.	+1.	−2.	+3.	+3.
3	−1.	+2.	−1.	0.	+3.
4	−2.	+1.	+1.	−3.	0.
5	−1.	−1.	+2.	−3.	−3.
6	+1.	−2.	+1.	0.	−3.
1	+2.	−1.	−1.	+3.	0.

These values of current in *A* and *B*, plotted as curves, are as shown in Fig. 3.

It will be noticed that between the instants 1 and 2, 2 and 3, 4 and 5, 5 and 6, the curves reach their maximum, which is higher than the value—3—given in the above tabulation for the instants under consideration.

As one result of the superposition of the three currents in only two circuits, the resultant currents are, as will be seen by referring to the figure, out of time-phase with the electromotive forces; the current in *A* lags behind the e.m.f. in *A*, and the current in *B* leads the electromotive force in *B*, while the two current waves taken together are perfectly symmetrical with the e.m.f. in *C*, and in opposite direction. It is on account of this phase angle between the e.m.fs. and the resultant currents in an open-delta transformer bank that for the transformers to

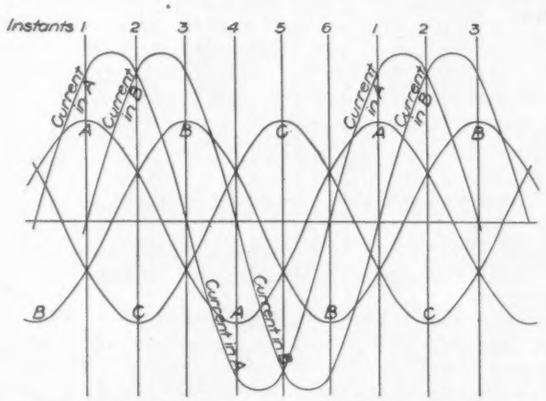


Fig. 3—Superposition of Three Currents on Two Circuits.

deliver the power at which they are rated they must carry 15.5 per cent excess current, as is well known, and as the following example shows:

Having three 10-kw transformers, with 100-volt secondary, delta-connected, the current in each winding is:

$$\frac{30{,}000}{100 \times 1.732 \times 1.732} = 100 \text{ amp.}$$

If, however, one transformer is removed, leaving the other two on open delta, and 20 kw is supplied, the current in each winding is:

$$\frac{20{,}000}{100 \times 1.732} = 115.5 \text{ amp.}$$

or for the same current in the windings, the rating must be

$$100 \text{ volts} \times 1.732 \times 100 \text{ amp} = 17{,}320 \text{ kva.}$$

The reduction of 13.4 per cent is the result of a time-phase displacement of 30 deg. (cos. 30 deg.=0.866).

VOLTAGE RELATIONS.

As a consequence of the current lagging in *A* and leading in *B*, the voltage of each phase will have a different regulation under load. This condition is shown in Fig. 4, where the

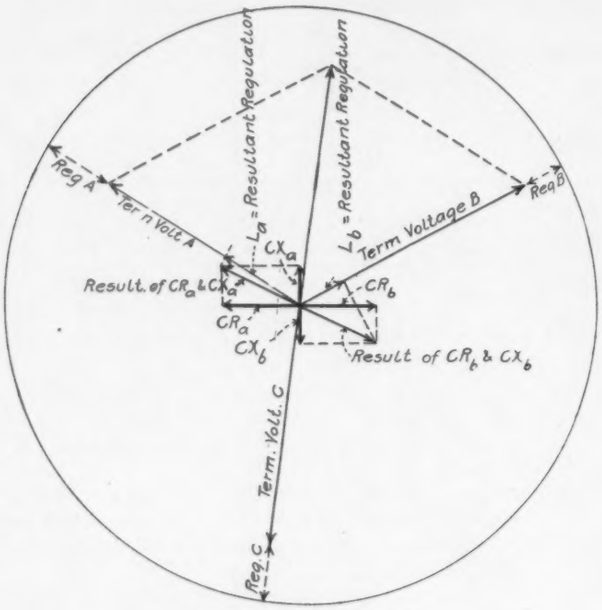


Fig. 4—Voltage Relations.

diagram has been laid out, not with pretense to great accuracy, but merely as an illustration.

It is seen that the voltage regulation in phase *A* is bad, on account of the 30 deg. current lag; in phase *B* it is quite good, due to the current lead; while the resultant of the terminal e.m.f. of *A* and *B* is the third phase *C*, which cannot be at 120 deg. from either *A* or *B*, since its components *A* and *B* are of unequal length. The only time at which the normal 120 deg. time-phase displacement can occur is when the lines L_a and L_b, which are the resultants of the resistance and reactance drops of the transformers, respectively, will be symmetrical with a line 60 deg. from *A* and *B*.

THREE-PHASE CIRCUIT RELATIONS.

Current Relations in, and Power-Factor of, an Unbalanced Three-Phase Circuit.

By R. K. McMaster.

The purpose of this article is to give simple methods of determining:

1. The currents in the three single-phase branches of an unbalanced three-phase circuit when the three line currents are known.

2. The power factor of an unbalanced three-phase circuit from single-phase wattmeter readings without the construction of a vector diagram. Sine wave-forms and equal phase voltages are assumed.

1. CURRENT RELATIONS.

From the three line currents in a three-phase circuit one cannot determine the currents in the single-phase branches unless the power factors of the latter are equal or are known. In this article it will be assumed that they are of equal but unknown power factor. Fig. 1 shows the notation used for the several currents involved.

In Fig. 2 the triangle *BAC* is laid off with sides proportional to the values of the line currents I_x, I_y and I_z. Upon any side, as *BA*, as a base, the equilateral triangle *BDA* is constructed and circumscribed by the circle *BOAD*. Drawing *DC*, its intersection with the circle locates the point *O*, from which are drawn the lines *OB*, *OC* and *OA*, representing the values of the phase currents I_{yz}, I_{xy} and I_{zx}, respectively. If, now, *BK* be drawn from *B*, parallel to *OA*, *BOK* is evidently an equilateral triangle; for the angle *KOB* measures 60 deg., being subtended

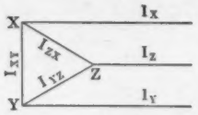


Fig. 1—Notation of Currents in Unbalanced Three-Phase Circuit.

by the 120-deg. circular arc *BD*, and the angle *OKB* is also 60 deg. being an opposite interior angle with *DOA*, which subtends the 120-deg. arc *DA*. Thus, in the equilateral triangle *BOK*, the side *OK* equals the side *BO*, and represents in value the current I_{yz}.

Also, *KD* equals *OA* and may represent I_{zx}; for the triangles *BOA* and *BKD* are equal, having as homologous parts the sides of the equilateral triangles *BAD* and *BOK*, and equal angles at *BKD* and *OAB* (both inscribed angles subtended by the arc *BO*).

Thus I_{zx} is represented by *KD*, I_{yz} by *OK*, and I_{xy} by *OC*, so that the whole line *DC* represents the value of the equivalent single-phase current which, at the same voltage and power factor, would deliver an equal amount of energy. If this equivalent single-phase current be represented by *S*

$$CD = I_{xy} + I_{yz} + I_{zx} = S \qquad (1)$$

Numerical examples may be solved conveniently by the use of Fig. 3, which is based on Fig. 2. The heavy arc is the circle of Fig. 2; the unnecessary lines are omitted, and there is added a system of circular arcs centered at *A*, *B* and *D*, together with a system of straight lines converging at *D*. The points *B* and *D* are not shown in Fig. 3. The line currents, in order of increasing magnitude, are represented by I_z, I_y and I_x, and all currents, both line and branch, must be expressed on a percentage basis, I_x, being taken as 100 per cent. I_{yz}, I_{zx} and *S* are found directly, but I_{xy} must be determined by subtracting the sum of I_{yz} and I_{zx} from *S*. As an example, take $I_x = 53$ amp, $I_y = 82$ amp and $I_z = 100$ amp. Following the dotted lines

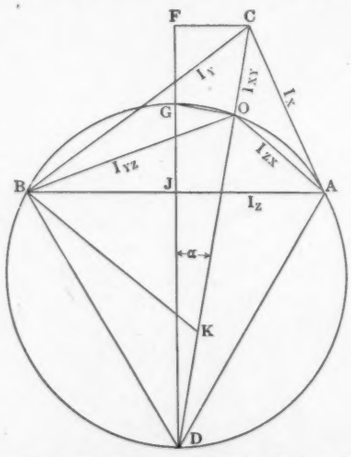


Fig. 2—Construction of Diagram for Determining Graphically the Phase Currents in Unbalanced Circuit.

in the figure, it is found that $S = 132$ amp, $I_{zx} = 42$ amp, $I_{yz} = 72$ amp, and $I_{xy} = 132 - (42 + 72) = 18$ amp. All reduction to and from the percentage basis can be done with one setting of the slide-rule.

In Fig. 4 equilateral triangles are constructed on two sides of the triangle *ABC*, the point *O* being the same as in Fig. 2. This construction is adapted for use where a separate figure is to be constructed for each numerical example.

The analytic solution of the problem is as follows, letting T be the double area of the triangle ABC, Fig. 2:

$$OD = DG \cos \alpha \; DG = \frac{2}{\sqrt{3}} I_z, \; \cos \alpha = \frac{DJ + JF}{S} = \frac{\frac{\sqrt{3}}{2} I_z + \frac{T}{I_z}}{S}$$

$$OD = \frac{\frac{2}{3}\sqrt{3}T + I_z^2}{S}$$

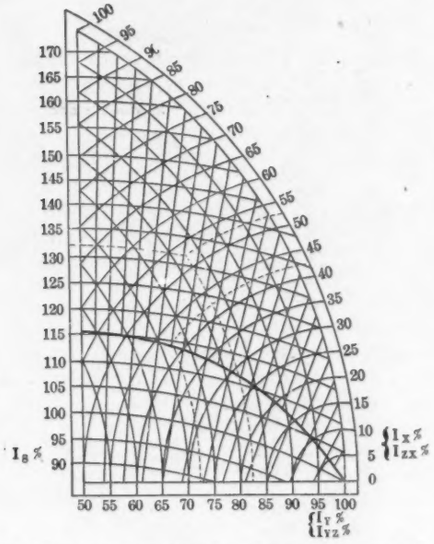


Fig. 3—Practical Form of Diagram for Finding Phase Currents in Unbalanced Circuit.

$2S = OD +$ two similar quantities, one involving I_x and the other I_y, respectively.

$$2S^2 = 2\sqrt{3}T + (I_x^2 + I_y^2 + I_z^2).$$

$$S = \sqrt{\tfrac{1}{2}(I_x^2 + I_y^2 + I_z^2) + \sqrt{3}\,T}. \qquad (2)$$

$$I_{xy} = S - OD = S - \frac{\frac{2}{3}\sqrt{3}T + I_z^2}{S}$$

Putting $S - \dfrac{\frac{2}{3}\sqrt{3}\,T}{S} = S', \quad I_{xy} = S' - \dfrac{I_z^2}{S}$.

Similarly $I_{yz} = S' - \dfrac{I_x^2}{S}$ and $I_{zx} = S' - \dfrac{I_y^2}{S}$

(3)

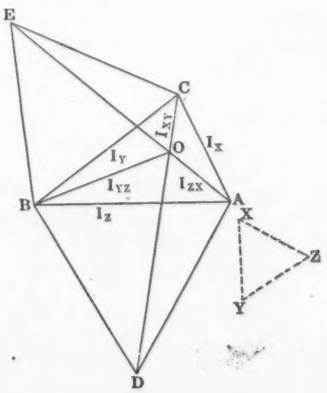


Fig. 4—Another Practical Form of Diagram for Finding Phase Currents in Unbalanced Circuit.

The graphic methods of Figs. 3 and 4, however, are preferable to the use of formulas (2) and (3).

If the loads on the three single-phase branches are not of equal power factor, as so far assumed, none of the methods outlined will, of course, give the correct branch currents. In Fig. 4 the dotted triangle represents the delta e.m.fs., and each of these makes the same angle with the corresponding current vector, say an angle θ, which is given by the formula cos θ = watts ÷ volt-amperes, wherein the value of current is S. Cos θ is clearly the power factor of the circuit when the three branch power factors are equal. When they are not equal, Fig. 4 represents a system of branch loads which would give the same line currents in the same phase relation to the e.m.fs. as do the actual loads, and which, therefore, has the same power

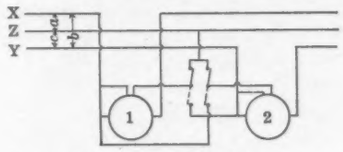


Fig. 5—Connections of Wattmeters.

factor. Hence, cos θ, as above calculated, is the equivalent power factor of the circuit, whether or not the branch power factors are equal.

2. POWER-FACTOR.

The power factor of an unbalanced three-phase circuit may be calculated from four single-phase wattmeter readings obtained from the two wattmeters usually installed. Referring to Fig. 5, when the switch is up, the connections are normal. Let the readings be W_1 and W_2. When it is down the potential coils are changed in phase. Let the respective readings be W_1' and W_2'. From the last paragraph under Part 1, it is seen that it is permissible to consider the load as made up of three single-phase loads of equal power factor whether it really is or not.

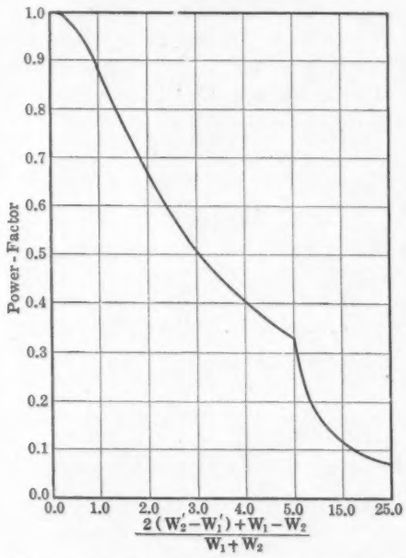


Fig. 6—Curve for Computing Power Factor.

Let these three loads be W_a, W_b and W_c, and let cos^{-1} (power factor) be θ. Then, in Fig. 7

$$W_1 = W_a + W_b \frac{\cos(60^\circ + \theta)}{\cos\theta}$$

$$W_2 = W_c + W_b \frac{\cos(60^\circ - \theta)}{\cos\theta}$$

$$W_1' = W_b + W_a \frac{\cos(60^\circ - \theta)}{\cos\theta}$$

$$W_2' = W_b + W_c \frac{\cos(60^\circ + \theta)}{\cos\theta}$$

Simultaneous solution of these equations gives

$$\sqrt{3}\tan\theta = -\frac{2(W_2' - W_1') + W_1 - W_2}{W_1 + W_2}$$

Fig. 6 is a curve plotted between cos θ and $\sqrt{3}$ tan θ, and, there-

fore, giving the power factor when $\frac{(W_2' - W_1') + W_1 - W_2}{W_1 + W_2}$ is known. Whether the sign of tan θ will come out plus or minus depends on which wattmeter is chosen for W_1, and on

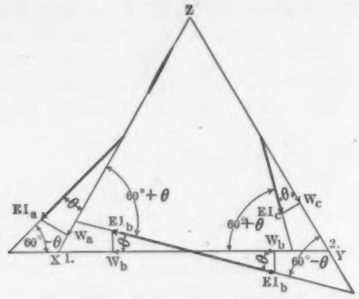


Fig. 7—Diagram for Obtaining Power Factor.

whether the load is lagging or leading. If the same wattmeter is always chosen for W_1 one sign will always indicate lagging load and the other leading. The chance that W_1' or W_2' will be negative is no greater than that W_1 or W_2 will be negative, and, with proper attention to sign, negative values may be used. If any of the readings are very low, it is well to make sure that the wattmeters are accurate under all conditions.

termine the accuracy of the methods above given, when applied to actual unbalanced three-phase circuits. The line currents and branch currents were both measured directly, thus giving a check on the branch currents as computed from Fig. 3. The

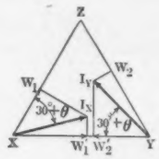


Fig. 8—Diagram for Balanced Load.

load was composed of banks of lamps and was, therefore, of 100 per cent power factor. By taking wattmeter readings with the potential connections shifted in phase, it was possible to get results corresponding to 50 per cent power factor leading and 50 per cent power factor lagging, except for a difference due to unbalanced voltage. The power factor was calculated by both methods and given.

TABLE I.—COMPARISON OF COMPUTED AND EXPERIMENTAL RESULTS FOR TESTING METHOD OF DETERMINING PHASE CURRENTS IN UNBALANCED LINES.

	Line Amp. (Observed).			Branch Amp. (Computed).				Branch Amp. (Observed).			Branch Amp. Errors.		
Trial	X	Y	Z	S	YZ	ZX	XY	YZ	ZX	XY	YZ	ZX	XY
I	24.5	25.5	26.4	44.1	15.8	14.8	13.5	16.0	14.2	13.6	− 0.2	+ 0.6	− 0.1
II	21.0	23.0	24.8	39.7	15.5	13.2	11.0	15.9	12.6	11.3	− 0.4	+ 0.6	− 0.3
III	18.5	19.7	23.4	35.2	14.0	12.9	8.3	14.9	12.2	8.2	− 0.9	+ 0.7	+ 0.1
IV	16.6	20.2	22.6	34.0	14.9	11.2	7.9	15.4	10.3	8.2	− 0.5	+ 0.9	− 0.3
V	14.7	18.0	22.0	31.0	14.3	11.0	5.7	14.9	10.3	5.8	− 0.6	+ 0.7	− 0.1
VI	10.1	12.95	19.75	23.1	12.8	9.9	0.4	12.6	10.1	0.0	+ 0.2	− 0.2	+ 0.4
VII	5.0	13.3	17.05	18.4	13.7	5.5	− 0.8	13.1	5.4	0.0	+ 0.6	+ 0.1	− 0.8
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Portable instruments were used, and corrections made for discrepancies between the instruments, determined by checking them against each other on single-phase load. The chief source of error in the results is the unbalance of voltage, but no correc-

TABLE II.—CALCULATION OF POWER-FACTOR.

	Voltage				Volt-Amp. (From columns	Total watts, $= W_1 + W_2$. From columns 27 and 28			Power-factor, per cent. From columns 19 to 22		
Trial.	YZ.	ZX.	XY.	Average.	5 and 18).	In phase.	60° lead.	60° lag.	In phase.	60° lead.	60° lag.
I	115½	119	116½	117	5170	5190	2640	2520	100	51	48½
II	114	122	117	117½	4660	4660	2410	2270	100	51½	48½
III	107½	119½	115	114	4010	4000	2080	1890	100	52	47½
IV	111½	124	115½	117	3980	3950	2070	1880	[1] 101	52	47
V	108	124½	117	116½	3610	3570	1920	1640	[1] 101	53	45½
	15	16	17	18	19	20	21	22	23	24	25

[1] Error due to voltage unbalance.

From Fig. 8 it will be seen that if the load is balanced the wattmeters will interchange readings when the switch is thrown over, and, conversely, that the load is balanced if the readings interchange. If the load is found balanced, the power factor may, of course, be calculated from W_1 and W_2 only.

tions for this were made because circuits with unbalanced load usually have unbalanced voltage also. However, in the last two cases given, the power factor calculation is omitted because of the errors due to the unbalanced voltage. It was further found that even with greatly unbalanced load there is little, if any, difference which two lines are chosen for the current connections to the wattmeter.

TABLE III.—CALCULATION OF POWER-FACTOR.

1	26		27	28	29	30	31	32
Trial.	Power-factor, per cent (according to connections).		W_1.	W_2.	W_1'.	W_2'.	$\frac{2(W_2' - W_1') + W_1 - W_2}{W_1 + W_2}$	[2] Power-factor per cent (by four watt-meter method).
I	100		+2570	+2620	+2510	+2470	−0.025	100
	50	Lead	+2510	+0130	−0050	+2620	+2.92	+ 51
	50	Lag	+0050	+2470	+2570	−0130	−3.10	− 49
II	100		+2290	+2370	+2130	+2110	−0.026	100
	50	Lead	+2130	+0280	−0160	+2370	+2.87	+ 51½
	50	Lag	+0160	+2110	+2290	−0280	−3.12	− 48½
III	100		+2040	+1960	+1780	+1630	−0.055	100
	50	Lead	+1780	+0300	−0260	+1960	+2.84	+ 52½
	50	Lag	+0260	+1630	+2040	−0300	−3.20	− 47½
IV	100		+1780	+2080	+1640	+1650	−0.048	100
	50	Lead	+1640	+0430	−0230	+2080	+2.82	+ 52½
	50	Lag	+0230	+1650	+1870	−0430	−3.20	− 47½
V	100		+1730	+1840	+1420	+1330	−0.081	100
	50	Lead	+1420	+0500	−0310	+1840	+2.72	+ 53½
	50	Lag	+0310	+1330	+1730	−0500	−3.34	−46

[2] + indicates lead; — indicates lag.

EXPERIMENTAL TESTS.

The accompanying tables give the results of tests made to de-

Central Station

Management, Policies and Commercial Methods

NEW PLAN FOR PLACING IRONS AT MARQUETTE, MICH.

The municipal electric light and power plant at Marquette, Mich., under the management of a commission, with Mr. Charles Retallic as superintendent, has been trying a new plan to introduce electric irons the past spring. Mr. Retallic has always used new business methods very similar to those employed by private companies to increase the profitable load on the plant. At the end of the fiscal year, March 8, 1910, the plant had 1420 residences connected and 918 electric irons. This spring the new plan of introducing irons before mentioned consisted of hiring a competent laundress from a local steam laundry by the month. She would visit a prospective electric flatiron customer and do a day's ironing, demonstrating how much more convenient the electric iron is than others, and what good work can be done with it. Incidentally, of course, the prospective customer learned something about ironing, as the woman employed was one of the most proficient in the laundry from which she came. The regular trouble man of the plant would set up a meter board in the kitchen the day before the trial, and thus the amount used for ironing was known exactly. Irons are sold for $1 down and $1 a month, the total price being $4. The commission also wires houses on the installment plan. The laundress is employed at $8 per week.

GAS COMPETITION.

The National Commercial Gas Association is sending to the gas companies of the country a circular asking for data upon which to base a campaign against electric lighting. Following are the questions to which replies are asked:

1. Are tungsten or tantalum lamps taking any of your business?—2. Have these lamps replaced other electric installations?—3. What is the size of tungsten and tantalum lamps most used (watts)?—4. Are they being used for factory lighting? If so, in clusters or single units (size)?—5. Does the electric company maintain them?—6. What do they charge for renewals, and for maintenance?—7. Do the manufacturers of tungsten and tantalum lamps handle their sale direct?—8. What is the average price of current?—9. Are you making any progress toward displacing tungsten and tantalum lamps?—10. Are you using arcs or reflexoliers to meet electric competition?—11. Do you have a regular system of maintenance, and if so, what are your charges?—12. Do you follow a rule for locating units in meeting tungsten and tantalum competition?—13. What is the price of gas?

The current issue of the N. C. G. A. presents an argument, with figures, to assist in displacing factory electric lighting plants in favor of gas lighting. The final conclusion arrived at is that "gas by all means is the best for factory use, from the standpoint of color as well as steadiness and strength of light."

DAY LOAD AT QUINCY, ILL.

The Quincy Gas & Electric Company, of Quincy, Ill., is not behind the times in the matter of securing day load. The company now has a connected power load of about 3000 hp, or about 2250 kw. Only about 65 kw of this is on alternating current, the rest being on the 550-volt direct current. The largest single power user is the Otis Elevator Company, which requires an all-day load of 150 hp. One or two wood-working shops are equipped with single-phase induction motors. The peak lighting load runs as high as 1400 kw. The arcs are of the usual 7.5-amp, alternating type, and are run about 50 to a circuit.

The electric superintendent, Mr. M. M. Hess, is very favorably impressed with the business from electric flatirons. He now has out more than 300 of these, and each is of a size which uses not less than 600 watts. In one instance a single family pays an average of $5 a month for ironing service alone. These irons are sent out on 30 days' free trial.

At the plant the generating equipment consists of engine-type, revolving-field alternators, and where small units are needed these are induction motor-generator sets. The main power unit consists of an 1800-hp engine direct-connected to a General Electric, three-phase, 60-cycle alternator, furnishing energy at a primary pressure of 2300 volts. The engines are simple and non-condensing, as the exhaust steam is sold for heating purposes on a large scale. This gives a back pressure as high sometimes as 16 lb., but it has not been considered worth while to install condensing apparatus to be used only one-third of the year, in summer.

ESTIMATED COST OF IMPROVEMENTS AT NEW BEDFORD, MASS.

At a recent hearing before the Massachusetts Gas and Electric Light Commission upon a petition for authority to issue new capital stock to the amount of $432,000, the New Bedford Gas & Edison Light Company presented an estimate of the cost of contemplated work for the season of 1910, which showed that the improvements under way will call for an expenditure of $127,356, the larger part of which is in application to the electric plant of the company. The principal items were: Turbine installation, $27,500; boilers and superheaters, $15,843; boiler house, piping, etc., $38,700; new electric work, $17,000; street mains, $23,750; gas works, $2,965; artesian well, $1,598. The electric plant items were given as follows:

ESTIMATED COST OF 1910 ELECTRICAL IMPROVEMENTS.

1000-kw Westinghouse-Parsons turbo-alternator (contract)	$23,000
" " " " " foundations	1,200
" " steam piping installation for turbine	800
New switchboard equipment for above	750
" electric wiring for above set	500
Removing present engine and shafting	375
Condenser installation	875
	$27,500
2—508-hp boilers	13,021
2—508-hp superheaters	2,822
Boiler foundations and settings	2,500
" steam piping	1,500
New flue with connection work	3,500
Coal bunkers and conveyors	6,500
Boiler house addition, steel frame	18,500
Reconstruction of present boiler house	2,700
Supervision	3,500
Total ($82.04 per kw)	$82,043
New 50-lamp tub transformer	1,500
" 300-kw motor-generator set	5,000
Extension of electric lines in New Bedford and Fairhaven	10,500

The company's officers stated that the new boiler plant is to be housed in an addition which will practically duplicate the present boiler-room. The wall between the two rooms will be removed and an improved coal-handling installation made. The arc-lighting service has in the past been supplied from Brush machines, but the future service will be operated from the turbo-alternator through the tub transformer. The company's street-lighting service is being extended or improved at the rate of 1.5 miles of wire every 10 days. The company recently installed a gas-engine unit, which will be operated during the hours of lighter loads with a small motor-generator set supplying the Edison day service. The new motor-generator of 300-kw rating will be used in connection with handling the larger load during the peak, which amounts to about 900 kw maximum direct-current service. The company is also making a vigorous campaign for power business.

CO-OPERATIVE LAMP ADVERTISING CAMPAIGN.

The member companies of the National Electric Lamp Association, the General Electric Company, the Westinghouse Lamp Company and the Franklin Electric Manufacturing Company have joined in a plan to offer to the electric lighting industry a series of efficient advertising campaigns. The campaigns are, for the most part, devoted to residence lighting, but touch less on commercial and industrial lighting, and are so designed as to cover a great variety of central-station conditions. Some 50 pieces of direct advertising in the form of booklets, folders, form letters, postal cards, etc., and about 40 newspaper advertising designs, have been collected. Every contingency anticipated in the way of peculiar local conditions has been provided for. Space is left in the body of the copy for the signature of the central-station company which is to distribute the matter, and in cases space is also allowed for special propositions, such as many central stations offer on wiring contracts. Several pieces are devoted largely to the wiring of old houses, and constant references are made to the advantages of having houses so wired as to enable the use of a flatiron, vacuum cleaner, heating devices and electrical appliances of all kinds.

In distributing this advertising the central station is asked to bear about one-fourth of the bare cost of printing. The lamp companies meet all the initial cost, which includes the expense of advertising experts, art work, color plates and unique designs. While this campaign is admittedly designed to increase the sale of incandescent lamps, its policy is based on the principle that to increase lamp sales, the consumers' demand must be increased. In the above manner the lamp manufacturers expect to increase the demand for electric light, understanding that every new socket requires another lamp.

ELECTRICAL PROGRESS AT SALIDA, COL.

Since the general inspection of electrical wiring in Salida, Col., by the Rocky Mountain Fire Underwriters' Association, in 1909, the improvement in class of installation has been more rapid than in any other city of the Rocky Mountain district. An electrical ordinance was passed upon the recommendation of the underwriters, and the manager of the Salida Light, Power & Utility Company was made inspector. Such a spirit of co-operation was established that not only has new wiring during the past year been in strict accordance with the National Electric Code, with a predominance of conduit construction, but fully 25 per cent of the mercantile section has been completely rewired with the same proportion of conduit and metal molding construction. This is a most unusual amount of rewiring, and indicates an exceptionally broad policy of the lighting company, and great effectiveness in the individual suggestions mailed each property owner by the underwriters.

The result has been to remove a fire hazard of unknown severity from a large part of the city's congested blocks, and at the same time to reduce the insurance tax for the former defective lighting. The gasoline lighting fire hazard has been greatly reduced at the same time.

Among the larger improvements under way they are now contemplating the passage of a gasoline lighting ordinance. The standardization of wiring has brought about a demand for removal of pole lines from streets to alleys, which is just being completed. A street-lighting scheme with steel poles set on either side of the main street has been adopted, 15 poles to each side spaced 80 ft., and each bearing a 100-watt series tungsten lamp on an ornamental bracket.

The Salida Light, Power & Utility Company has been obliged to make considerable additions to its equipment recently to supply the growing demands of Salida. Two hydroelectric stations near Maysville are operated, No. 1 having three 200-kw generators and No. 2 two 300-kw generators. One of the latter has just been installed. The wheels operate under about 400-ft. head, using Replogle governors. The voltage is governed by a Tirrill regulator at each plant. It is stepped up to 17,000 volts in delta, and separate three-phase lines convey the energy to the Salida substation, from which city distribution is made at 2000 volts. A large load is also supplied by the Salida smelter, from a separate substation.

A load of 300 kw has just been secured from the Denver & Rio Grande shops, which have abandoned their steam plant, except as a reserve.

The present street-lighting arrangements of Salida are being entirely replaced by the installation of two mercury-arc rectifier sets, the load to consist of about 65 4-amp arc lamps, and 30 4-amp tungsten lights for decorative illumination. In connection with this change, the substation has been completely rewired with all low-voltage wires in conduit.

An additional load of 100 kw is probable to operate a booster pump of 1000 gal. per minute for the city water service. The present pressure is unsatisfactory, especially from a fire standpoint, and the above arrangement will secure effective pressure for fire fighting at a minimum cost to the city. It will also be a principal factor in securing a better classification for Salida from an insurance standpoint, and is being considered by the City Council from this standpoint.

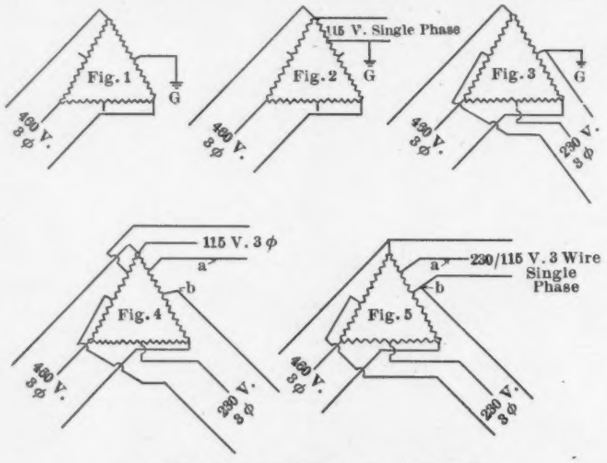
GROUNDING THE SECONDARY.

Following are rules which have been adopted by the Central Colorado Power Company prescribing details for the grounding of the secondaries of transformers connected to its system:

All transformers connected to distribution circuits of less than 500 volts rating must have their cases thoroughly grounded and the secondary circuits must be grounded with sufficient capacity to blow the primary fuse of the installation. The point of the winding to be grounded is shown by the accompanying diagrams for several arrangements of transformers.

Fig. 1 shows the middle point in one transformer grounded, thus giving a maximum potential to ground of 230 volts from each of two wires, and 396 volts for the other wire.

In Fig. 2 the maximum potential to ground on the lighting



Figs. 1 to 5—Grounding the Secondary.

circuit is 115 volts. On the three wires of the motor circuit the potentials to ground are respectively 115 volts, 245 volts and 413 volts.

In Fig. 3 the potentials to ground on the 460-volt, three-phase circuits are respectively 230 volts, 396 volts and 230 volts. On the 230-volt circuit the potentials to ground are respectively 0, 230 and 230.

In Fig. 4 the potentials to ground on the lighting circuit, with the ground connected at *a*, are respectively 0 volt, 115 volts and 115 volts. With the ground connected at *b*, the potentials are respectively 115 volts, 230 volts and 199 volts. Therefore, in cases where the three-phase lighting circuit is taken out of two transformers and it is desired to afford the lighting circuit better protection than is provided for the motor circuit, the ground should be connected at *a*. On the motor circuits, the

potentials to ground on the 460-volt circuit, with the ground connected at *b*, are the same as in Fig. 1. The maximum voltage to ground is increased slightly if the ground is connected at *a*. In general, it will be advisable to ground the point *a* when this connection is used.

In Fig. 5 the potentials to ground on the three-wire, single-phase lighting circuit, with *a* grounded, are respectively 115 volts, 0 volt and 115 volts. With the point *b* grounded, the potentials become 0 volt, 115 volts and 230 volts. With the point *b* grounded, the potentials on the motor circuits become as in Figs. 1 and 3. With the point *a* grounded, the potentials become 345, 115 and 413 on the 460-volt circuit, while on the 230-volt circuit the potentials to ground become 115 volts, 199 volts and 304 volts.

In case the secondary winding of the transformers is star-connected and the voltage of the secondary circuit is less than 500 volts between wires, then the neutral point of the star-connection will be grounded.

The circuits may be grounded to the same ground connected to the transformer cases, but neither connection should have the same ground as the primary arresters. The exception to this is that both systems of ground connection may be made to the same water system, provided the water system is thoroughly grounded between the points of connection for the primary arresters and the secondary circuits.

The secondary ground connection should be made to a thoroughly grounded water-pipe system or to a first-class ground-plate installation, or, if these are not available, three pipes not less than 1 in. in diameter should be driven into the ground not less than 10 ft. apart, each pipe being not less than 5 ft. long. The ground wire should be connected to each pipe independently. The ground wire and all its connections at the transformer must be installed to insure its greatest possible safety from mechanical danger.

Wiring and Illumination

SPECIAL STREET LIGHTING IN RIVERSIDE, CAL.

Contemplated improvements in the River Crest tract, Riverside, Cal., a fine residence district, include an ornamental street-lighting system on Aurora Drive. It is proposed to place concrete posts supporting electric lamps at intervals of 50 ft., but the details have not been settled.

MOLYBDENUM ARC-LAMP ELECTRODES.

Information concerning the characteristics of molybdenum used as a material for arc-lamp electrodes is given in two patents granted on June 14 to Mr. George A. Thomson. The inventor states that by the use in an arc lamp of a metallic electrode containing molybdic material, an arc of great brilliancy can be produced and that the light from such arc will be white and of maximum volume. The molybdic material may be in the form of metallic molybdenum, associated with a material having greater electrical conductivity than metallic molybdenum. The molybdenum oxid may be in comminuted form and held together by suitable binding material, and other material (such as metallic iron) will preferably be added to increase the conductivity of the electrode. It is said that excellent results have been attained with the use of an electrode containing as much as 86 per cent metallic molybdenum. It has also been found that an arc of large volume and great brilliancy giving white light can be produced with the use of an electrode employing concentrates made from molybdenum ore containing approximately 15 per cent oxid of molybdenum, sand concentrates being inclosed within an iron tube.

An arc of great volume and brilliancy with white light can be produced with the use of a ferro-molybdenum electrode containing approximately 10 per cent of metallic molybdenum and 90 per cent metallic iron.

NIGHT ILLUMINATION OF A LUMBER YARD.

Work can be carried on all night at the large lumber yard of the Thornton-Claney Company, Chicago, with the aid of flaming-arc lamps mounted high on the masts of the derricks which are used for the transfer of material. Each derrick comprises an 80-ft. mast carrying a 75-ft. horizontal boom, guyed from the top of the mast. The hoisting and rotating motions are operated by a 15-hp induction motor. Six feet above the top of each mast four flaming arcs are mounted, controlled from two switches, one for each pair, thus simulating the "moonlight" effect secured by the old system of tower-lighting formerly used in several American cities. This scheme of illumination, applied to three derricks, has been found admirable for supplying a uniform working illumination over the entire yard.

ELECTRICITY ON THE ENGLISH ROYAL TRAIN.

Electricity is used for a variety of purposes on the royal train of England besides lighting. Each of the two royal saloons is lighted indirectly by over 150 incandescent lamps, which are placed in a trough hidden above the molding, the light being reflected from the ceiling of the car. It is stated that shadows are thus eliminated.

In addition to the lamps, there are electric radiators, cigar lighters, foot warmers, electric coffee pots and kettles, and fans for ventilating purposes. Hot air can be supplied in the winter season and cool air in warm weather. Hot water for use in lavatories is heated by electricity. Each coach is equipped with two axle-driven generators, one on each truck, the heavy load on the two saloons calling for the extra equipment. The Stone system is used.

INDIRECT LIGHTING IN A RAILROAD OFFICE.

A noteworthy example of indirect lighting is that of the Western Passenger Association's conference room in the Railway Exchange Building, in Chicago. The work carried on in this room is of an exacting nature and very trying to the eyes and the problem of lighting the room in a satisfactory manner required careful consideration. The "Eye Comfort" indirect lighting system was installed, and, it is stated, entirely relieves the eye of strain and fatigue, a strong, even distribution being secured. The size of the room is 27 ft. x 45 ft. and 11 ft. high. The ceiling is of a light cream color, the upper part of the walls being tinted yellow. The lockers, woodwork and furniture are of mahogany. The installation consists of three fixtures hung 36 in. below the ceiling, each containing six 100-watt lamps in diffusing-type reflectors. With six lamps in use per fixture the intensity of illumination upon the table is stated to be about 3.75 ft.-candles.

SPECIAL SERIES-TUNGSTEN STREET LIGHTING.

Broadway, the principal thoroughfare of the new steel-manufacturing city of Gary, Ind., has a special street illumination employing series tungsten lamps on ornamental posts. Each regular post carries two 60-watt and one 100-watt series tungsten lamps, while the special standards marking the street intersections are fitted with an extra pair of arms carrying two 60-watt tungstens at right angles to the regular arms. This lighting is in addition to the regular city arc lamps mounted on the center trolley poles at 300-ft. intervals.

The series circuits are supplied with a constant current of 66 amp by tube-type regulating transformers, from the 2200-volt, 25-cycle secondaries of the substation transformers, which reduce the 6600-volt transmission potential from the steel-plant power house. As the energy for these lamps, as for all the commercial lighting of Gary and vicinity, comes from the bus-bars of the great blast-furnace gas-driven station which also supplies the large mill motor load, including units up to 6000 hp, some variation in the lamps is at times noticeable. Each lamp is equipped with an automatic film cut-out, and an additional

cut-out is provided in the base of the standard, controlling the group. Lead-covered cable carrying 6600 volts has been used in the conduit work.

The standards have a cast-iron base, fitted with a hinged door for access to the group cut-out. The post proper is tapered out of two sizes of wrought-iron pipe ending in an ornamental cup-piece from which wrought-iron goosenecks carry the lower lamps. The posts are spaced at distances of 50 ft. on each curb,

Fig. 1—Special Series-Tungsten Illumination, Broadway, Gary, Ind.

and the posts on the two sides of the street are opposite one another.

Eighty of these standards—66 three-lamp posts and 14 five-lamp posts—have been in operation for several months. The special illumination is now being extended south on Broadway by the addition of 71 more posts, 19 of which will carry five lamps each. The lighting of Broadway is considered such a thorough success by the local merchants that extensions along the side streets are under consideration.

The Broadway illumination was installed at the expense of the abutting property owners, who paid $1.25 per front foot. This figure may be taken to represent very nearly the actual cost of the installation, as it was necessary for the lighting company to assist in erecting the corner five-lamp posts. A standard post complete cost $70. The cost of energy and maintenance is defrayed by the city, which pays about $500 a year to the lighting company for electricity, looking after renewals, etc. The special illumination continues from dusk to 11 p. m., burning an average of five hours per night throughout the year. With allowance for maintenance, this makes the sale price of the energy about 6 cents per kw-hour.

The Gary Heat, Light & Water Company, which supplies electricity for commercial and domestic purposes in Gary, is a

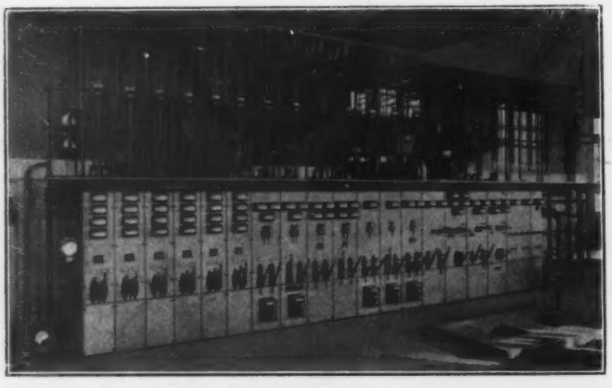


Fig. 2—Switchboard in Substation of Gary Heat, Light & Water Co.

subsidiary of the Indiana Steel Company which operates the great mills. The electric company has a modern and very ornamental substation, in combination with its motor-driven water-pumping plant. This station receives 6600-volt, 25-cycle, three-phase energy from the blast-furnace gas-engine-driven generating station of the steel company, transforming it to 2200 volts for local distribution, and also supplying the 150 street-lighting series arcs with 60-cycle energy through motor-generator frequency-changing sets and constant-current transformers. The Gary substation represents the most modern and approved practice at the time of its construction two years ago. It was laid out to serve the future city of 200,000, which the steel company's actuaries predict must eventually be located at this point. As the result of the ample transforming equipment installed, the Gary substation at present has the distinction of supplying more energy to its own transformer losses than is purchased by all its consumers. According to the station instruments, of about 110,000 kw-hours supplied monthly to the substation, only 30,000 is charged for on customers' meters. The present population of the city is 22,000, although this figure is growing rapidly. The company now has 1200 electric customers, each using an average of 35 kw-hours per month. The lighting rates are 11 cents per kw-hour for the first 50 kw-hours, 10 cents for the next 25, 9 cents for the next 25, 8 cents for the next 200, and 7 cents for all over 300 kw-hours' monthly consumption; all subject to a 10 per cent discount. The power rate is 7½ cents per kw-hour, for one hour's use per day of the rated horse-power of motor, after which the charge drops to 3½ cents per kw-hour. Lower rates are available for power customers whose monthly bills are over $50. Mr. Leonard Fitzgerald is superintendent of the Gary Heat, Light & Water Company.

IMMENSE ANIMATED SIGN ON BROADWAY, NEW YORK.

On Saturday evening, June 18, there was placed in operation on the roof of the Hotel Normandie, Broadway and Thirty-eighth Street, New York, one of the largest animated signs ever built. The sign contains about 20,000 incandescent lamps, ranging in size from 2 cp to 32 cp, and in the reflectors which illuminate the sky 100-watt tungsten lamps are employed. The Rice Electric Display Company, which operates the sign, estimates that about 600 hp is required on the structure. The latter rises 72 ft. in the air above the roof of the hotel, and is

Fig. 1—Huge Animated Sign Facing Herald Square, N. Y.

90 ft. wide. It is built to carry out a Roman chariot race of such design and proportions for each figure in the race that in the street below the vivid scene of light, color and action is reduced to normal proportions. Fig. 1 shows the scene from a near-by roof. To understand the size of the structure and its realistic show it may be mentioned that the main chariot driver and horses are 20 ft. high and 40 ft. long. The wheels of the chariot are 8 ft. in diameter.

The design of this moving picture is based upon the operation of the lamps in great part. These flash until the walls of the arena appear to be left behind. When the motor-operated switches are thrown in, foremost in the race appears a huge pair of horses outlined in flame, galloping madly and drawing the rolling chariot and giant driver on to victory. The arena track apparently moves from beneath the swiftly rolling wheels

Fig. 2—Leading Chariot Horses.

and plunging horses. Back of the main chariot is another chariot also in motion.

The front of the stadium wall is decorated with festoons of colored bulbs gracefully draped in artistic clusters. The different figures and stagings are all cut out in their exact shape from

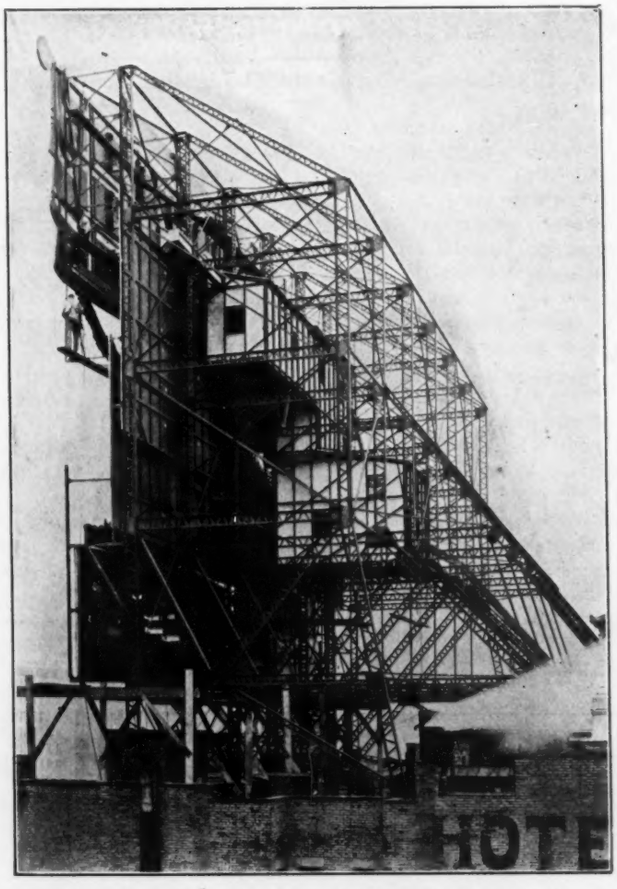


Fig. 3—Framework of Sign and Flasher Compartments.

metal. The chariots, traces, capes, breast collars and harness are painted in red and gold and studded with ruby and amber lamps. The roadbed of the arena is appropriately painted to represent tracks and dust, and is illuminated with over 1000 bulbs.

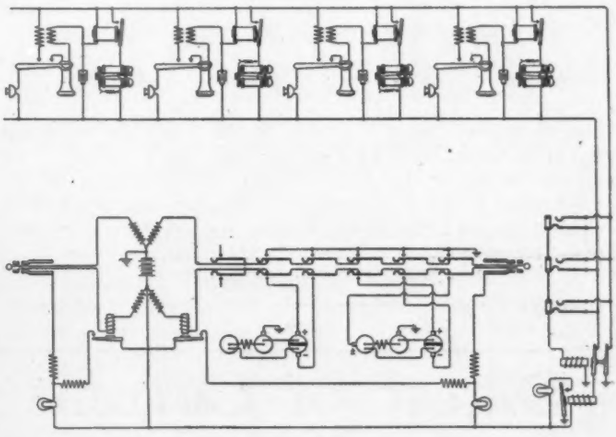
With one device the position of the horses' limbs is changed, throwing them smoothly backward and forward with such speed and grace, in electricity, as to cause the horses of fire to appear to be running at a terrific speed. Another device causes the wheels of the main chariot to appear to revolve so swiftly that the spokes cannot be seen. Every little detail, even to the illusion of dust rolling up behind the wheels and from beneath the hoofs of the horses, is carried out. Another device causes the crimson robe of the leading charioteer, as well as his Roman skirt, to flutter behind him, making the race more realistic. The manes and tails of the horses appear to be blowing fiercely in the wind, and while the great chariots and horses appear to be plunging onward the lamps illuminating the road bed are operated by means of flashers so that the road appears to recede from under the flying hoofs and rolling wheels. The lamps that decorate the center of the arena walls are also made to move in a direction opposite to that of the chariots which, together with the moving effect of the roadbed, adds wonderfully to the general action and completing the illusion, as though the great race were actually passing around the amphitheater.

At the top of the display, in midair, hangs a great steel curtain 90 ft. long and 20 ft. high, outlined with a border of ruby lamps. This curtain is decorated with fringe and heavy cord and tassels carried out in mammoth proportions, and is suspended directly over the main horses so as to dominate the entire display. This space is used for advertising and covers nearly 1800 sq. ft. On this surface each advertisement is displayed in turn, room being provided for 54 letters and spaces. These rows of 18 letters each are made up as monograms, each of the monograms being 4 ft. high and studded with lamps capable of being read at a great distance. The sign is lighted every night from dusk until midnight, and every 9 or 10 minutes the program is repeated. About 2750 switches are operated by means of two 10-hp motors, and the flashers are designed to give 2500 impulses of light per minute.

NEW TELEPHONE PATENTS.

ARRANGEMENTS FOR PARTY LINES.

The harmonic system of selective ringing may be said to be one of the two four-party selective systems in most general use to-day. Its rival is the pulsating current biased bell system of somewhat earlier adoption. However, many feel that the



Currier Party Line System.

harmonic system has one point of vantage over the pulsating system in that it requires no grounded bells. Again, there are just as many persons who feel that four frequencies for harmonic selection render adjustment against cross rings too close, as the available range of frequencies is limited. It would seem, therefore, that a mixed system leaving out both objections might have merit. This is evidently the idea of H. D. Currier, of Bloomfield, N. J., who has invented such a hybrid system. A diagrammatic sketch is shown in the illustration. In this system biased bells are used differentiated by biasing and poling to respond to impulses of a predetermined polarity.

Two such bells oppositely poled form a group. Their circuits are controlled by two harmonic relays which respond to the same frequency. Thus one frequency gives two selections, and two widely different frequencies give four selections. For furnishing the ringing currents two pulsating generators of proper frequency must be used. Mr. Currier has assigned his patent to the Western Electric Company.

Another patent assigned to this same company is that of H. L. Wuerffel, of Maywood, Ill., for a bell of the harmonic pattern. The novelty lies in the adjustment of the armature to mid or other desired normal position. The cross-member of the ringer frame is mounted upon the core extensions. It has two depending ears, between which a screw extends. Its head engages one ear and its threads the second. Slip springs serve to connect flexibly the armature piece of the ringer, with its mounting, a cylindrical piece surrounding the aforementioned screw and filling the space between the ears. The armature may be adjusted rotating the cylinder about the screw and the latter will serve to clamp the parts in position if brought down upon the ears. If desired, a cam adjuster may be used to rotate the cylinder before clamping.

W. S. Conner, of Oakdene, England, has patented a load distributing system for multiple frequency ringing. His system contemplates automatic intermittent ringing. To distribute the load he uses several interrupter commutators for each frequency and the several interrupters are angularly displaced in such a way that the live parts of no two for any one frequency overlap. By distributing the operator's cords to different interrupters the ringing load may be regulated. This patent is assigned to the Stromberg-Carlson Company.

J. W. Nilsson has patented a device which may be termed a listening-in telltale. He arranges at each station of a party line a device operated by the rising switchhook, which cuts in a transmitter exposed to one or more bells. These latter are tapped in code so as to indicate to the stations conversing as to just who is trying to listen in.

A system devised by H. F. Joeckel, of Clayton, Ind., relates to lines with a large number of bridged stations. He provides switching means for their hand generators and clearing out drops so that grounded signals may be sent where it is desired.

NEW TRANSMITTERS.

Two patents have recently been obtained for transmitters in which the inertia of the parts serves in lieu of a solid mounting for the rear electrodes. One of these transmitters, the invention of G. N. Quinby, Jr., of Providence, R. I., uses a single microphone button of usual proportions. The clamping nut of the auxiliary mica diaphragm is more conical than usual, and an inclined recess is formed in the diaphragm to receive it. It is drawn home by the usual clamping nuts. No other support is given the button. The inclined recess in the diaphragm gives an inclination to the electrodes which it is claimed gives a better normal contact between the granules and the electrode.

A transmitter invented by P. Stragiotti, of Hurley, Wis., embodies the same features as the transmitter part of his repeater. Two microphone buttons are used placed opposed to each other with a common stud for the movable electrodes. The diaphragm is linked to this common stud. The buttons are attached to a frame which in turn is mounted to swing freely in the direction of motion of the front electrodes.

COMBINED FIRE ALARM AND TELEPHONE.

Mr. J. G. Nolen, of Chicago, has obtained an additional patent to an association of a fire alarm with the telephone system. Alarm signals are given by a buzzer which is included in the common battery telephone line, but which is normally short-circuited. When one of the distributed alarm contacts is closed, an alarm machine is released. This in turn lifts the short-circuit from the buzzer, sets a calling signal upon the switchboard, and indicates the station where the alarm originated by a code signal. The code is marked by interruptions of the buzzer circuit.

RECEIVER.

A novel receiver forms the subject of a patent granted to N. Baldwin, of Heber, Utah. A special armature piece is provided which takes the form of a slip of magnetic metal suspended within the bore of the receiving solenoid. This armature is pivoted at one end and connected by a tension member with the middle of the diaphragm at the other. Many different methods of assembling and different arrangements of the different elements are shown, but in all the slip armature is placed to form part of the magnetic circuit of a V-shaped polarizing magnet.

Letter to the Editor.

Illumination from Extended Lighting Sources.

To the Editor of Electrical World:

Sir:—The well-known physical relation between the light produced at a certain point and the exposed area of the lighting source deserves to be applied in photometric calculations to a much greater extent than is done at present. This remark applies particularly to cases dealing with problems involving the determination of the distribution of illumination obtained from an extended lighting source, such as an artificial window. For example, it can readily be shown that the illumination produced at any point in a room by means of a uniformly brilliant artificial window depends solely upon the surface brilliancy of the window and the "solid angle" subtended by the window when viewed from the point under consideration. It matters not what may be the shape of the window or the distance to the point lighted, the illumination varies exclusively with the product of the two quantities just mentioned.

A recognition of this fact on the part of designing illuminating engineers should render unnecessary the many involved equations based on "inverse squares" and "cosine laws" and the accompanying simplifying approximations always resorted to at present when solving problems relating to extended surface lighting sources.

Richmond, Va. Joseph Thompson.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Cascade Converter.—H. S. Hallo.—The first part of an article illustrated by diagrams on the Arnold-La Cour cascade converter which consists of a polyphase motor and a standard direct-current machine electrically and mechanically coupled together. The author first discusses some characteristic features of the cascade converter and especially the effect of frequency. He shows that a cascade converter has great advantages over the single-armature rotary converter, especially for high frequencies and for high commutator voltages. The effect of reactance on the dimensions of the machine and on the wattless current obtained during regulation of the direct current is also discussed. If the slots are completely closed, the wattless current is greatly diminished, especially when the compounded cascade converter runs with no load or is only slightly loaded. —*Elek. Zeit.*, June 9.

Regulating the Speed of Induction Motors.—A. Scherbius.—An illustrated description of a new method of regulating the speed of induction motors employed by Brown, Boveri & Company. The principle of the system is that the slip-rings of a normal polyphase or single-phase induction motor are connected to a polyphase commutator machine, both being also mechanically coupled; they may either be placed on the same axle or connected by gearing. The commutator motor gets only a

small power corresponding to the percentage of the regulation. The primary of the induction motor may be directly connected to the high-tension mains. The well-known cascade connection of two induction motors permits speed regulation only in steps, since the second induction motor has a distinct frequency determined by the speed and the number of poles. On the other hand, in the cascade connection of an induction motor with a commutator motor, it is possible to subdivide the regulation steps at will, since the commutator motor can be operated at any frequency. A description of various machines of this type for driving pumps, mine ventilators, rolling mills, etc., is given.—*Elek. Kraft. u. Bahnen,* Feb. 24 and May 4.

Single-Phase Induction Motor.—G. BENISCKE.—The old theory of the single-phase induction motor, based on the conception of resolving it into two polyphase motors revolving in opposite directions, has been criticized by various authors, but the present author endeavors to show that this method gives correct results. It permits one to derive not only all peculiar features of the torque, but also the relations between power, slip and loss of heat by current in the rotor.—*Elek. Kraft. u. Bahnen,* Feb. 4.

Lamps and Lighting.

Ship Illumination and Fittings.—G. AUSTIN.—A fully illustrated article in which the author discusses the character of lighting and fittings suitable for decks, cargo holds, cattle spaces, emigrant accommodation, seamen's and officers' quarters, passengers' cabins, dining saloons, lounges, drawing-rooms and smoking-rooms, signal lamps and navigation lamp indicator. It is necessary that particular attention should be paid to insulation and the prevention of trouble by vibration. There are also articles on the use of various lamps like osram lamps, tantalum lamps, etc., on shipboard.—Supplement to Lond. *Electrician,* June 10.

Search-Lamp Projectors for Marine Purposes.—E. A. HOLMES.—An illustrated article stating that the search-lamp projector has now become a necessity alike in the British Navy and in the mercantile marine. Parabolic mirrors for projectors are usually of glass, silvered at the back, the precision of manufacture depending upon the quality of the result desired. The accuracy can be determined by two simple tests. The carbon electrodes are usually horizontal and may be adjusted by hand or will burn automatically. In conclusion, some special accessories are described. There are also illustrated descriptions of various types of search-lamp projectors.—Supplement to Lond. *Electrician,* June 10.

Vertical Illumination.—P. HOEGNER.—An article illustrated by diagrams in which the author describes a simple method for calculating the illumination of a vertical surface from the illumination of a horizontal surface. The application of the method is illustrated by an example relating to street lighting. —*Elek. Zeit.,* June 9.

Generation, Transmission and Distribution.

Electric Power from Blast-Furnace Gas.—R. PORKORNY.—The author discusses the use of blast-furnace gas for the generation of electrical energy and shows that a blast-furnace plant combined with a steel plant and rolling mill can generate all the electrical energy necessary for their operation and accessories from the available blast-furnace gases. Detailed figures are given and it is shown that the gas-engine plant is preferable to a steam-turbine plant, and further that the purification of the blast-furnace gas required for the operation of the gas engines is economical.—*Stahl und Eisen,* June 8.

Water-Powers of Bavaria.—T. KOEHN.—A review of a new official memoir on the possibility of developing the water-powers of Bavaria. The term "mean water-powers" relates to such as are available at least seven months (210 days) per year. On this basis there are available in southern Bavaria 560,000 hp and in northern Bavaria (north of the Danuvia) about 9000 hp. Their development to the turbine axle would cost not more than $250 per horse-power, but in southern Bavaria, where there is an abundance of water-power, there is no industry. Hence, the transmission of energy to considerable distances would have to be considered. The State railway department of Bavaria has reserved the right to develop eight water-powers for its own purposes, if it should be decided to electrify all the State railways of Bavaria.—*Elek. Zeit.,* June 9.

Water-Powers in Austria.—W. CONRAD.—A statistical paper discussing the commercial value of the water-powers which could be developed in the Austrian Alps. He finds that a total of 2,000,000 hp could be developed. This is comparatively a small amount, but even so if this whole power were developed it is doubtful whether it could be used with commercial profit. The author begins a discussion of this point in some detail.—*Elek. und Masch.* (Vienna), May 29.

Electric Stations for Agricultural Districts.—There is now a tendency in Germany to erect large stations in agricultural districts and there is a propaganda that the money for their erection should be invested by the counties. In the county (Kreis) of Syke, in the province of Hanover, in Prussia, the existing electric stations protest against this propaganda and claim that the three large electric manufacturing companies of Germany are behind this scheme and are trying to monopolize the whole electricity supply in Germany.—*Jour. f. Gasbeleucht,* May 14.

Electric Torque Transmission Gear.—A note on a recent British patent (6758, 1909; June 2, 1910) of W. P. Durtnall for a polyphase system with three different speeds. The high-speed steam, gasoline or oil engine drives the magnet-wheel of a four-pole polyphase generator with a fixed stator. The latter supplies electrical energy to the stator of an eight-pole induction motor, which is also attached to the engine shaft. The squirrel-cage rotor of this motor is coupled to the first motion shaft of the vehicle or hoisting gear to be driven. It rotates independently of the engine shaft, or may be coupled to it by an electromagnetic clutch for direct drive. A change-over switch between the generator and motor enables the electrically produced rotation of the motor field to be added or subtracted from that due to the mechanical rotation of the motor stator.—Lond. *Elec. Eng'ing,* June 9.

Main Shaft Winding.—G. C. LEBER.—The conclusion of his illustrated article on the electric main shaft winding system of Brown-Boveri & Company in use in the Mauve mine. The 565-hp, direct-current motor, the starting turbo-generator and the steam turbine with automatic valve, which are the chief features of the system, are described in some detail, and data are given of the practical operation in the mine.—*Elek. Zeit.,* June 9.

Electrically Driven Shipyard Cranes.—H. H. BROUGHTON.—An illustrated article in the first part of which certain detail work which affects the performance of all types of electric cranes is briefly considered. In the second part descriptions are given of several cranes and crane systems which are in use in a number of the principal British shipyards. Yard cranes, building ship equipments and fitting-out basin cranes are dealt with.—Supplement to Lond. *Electrician,* June 10.

Traction.

Electric Traction of Railways.—B. GLEICHMANN.—A report presented to the International Railway Congress of Bern. The author gives an outline of the preparatory investigations which have been carried out on high-speed electric traction and electric traction on railways by three German Government departments. He sketches the object of the electrification of railways and discusses the best system and the reasons which have led the above-named three departments to adopt the single-phase system with a frequency of 15 and an e.m.f. of 10,000 volts on the trolley wire. He then deals with line construction, effect on telegraph and telephone lines, and the construction of electric locomotives.—*Elek. Kraft. u. Bahnen,* April 4, 14 and 24.

Single-Phase Traction in Italy.—C. H. EIGENHEER.—A detailed description of the single-phase railway from Padua to Fusina. In the city of Padua use is made of single-phase current at 600 volts, while outside of the city single-phase current at 6000 volts is employed. The frequency is 25. Each motor-car is equipped with two 80-hp Winter-Eichberg motors operated at 600 volts.—*Elek. Kraft. u. Bahnen,* April 23, May 4 and 14.

Mont Cenis Line.—Since there will be an international ex-

hibition in Turin in the spring of 1911, a large increase of traffic is expected, and it is intended to complete the electrification of the roads to Turin by that time. For this purpose the Mont Cenis tunnel line is now being electrified. This will be operated by means of three-phase locomotives at 3500 volts in a double trolley wire line, the frequency being 15. Electric energy is supplied from the hydroelectric plant at Turin at 50,000 volts with a frequency of 50 cycles. The currents are transformed in a substation in Bardonnecchia to 15 cycles. This is the first large European substation for trunk railroad operation in which three-phase currents are transformed from 50 cycles to 15 cycles in relatively large machine units. Further interest is attached to the use of large flywheels and of three-phase commutator regulators, so as to render the operation more economical and avoid the use of three-phase, direct-current converters and storage batteries which would be necessary to equalize the fluctuations of load.—*Elek. Kraft. u. Bahnen,* March 14.

Storage-Battery Motor Cars.—M. Büttner.—Since the results obtained with storage-battery motor cars on street railways have been exceedingly unsatisfactory, great surprise was expressed when several lines of the German State railways on which the passenger traffic is relatively small decided to install storage-battery motor-cars. However, the success attained in regular operation in several years proves that the conditions of street railways and interurban railways are quite different and that in the latter case storage-battery cars are quite satisfactory. They became really commercial only after improvements had been made in the design of the storage battery. It is now possible to run a car for 100 km (60 miles) with an average speed of 50 km per hour (30 miles per hour) with one charge of the battery. On the Palatian railways, where such cars are now in use and are considered a commercial success, the cost of the kw-hour is from 2.5 cents to 2.8 cents. The cost of operation per kilometer is 8.75 cents, of which not less than 4 cents is the cost of energy. It is evident that the less the cost of energy the more economical is the operation. The expense with the 63 storage-battery motor-cars so far installed shows that they are not only very reliable in operation, but are cleaner and more comfortable than any other cars.—*Elek. Kraft. u. Bahnen,* April 14.

Electric Locomotives.—W. Heyden.—An illustrated description of the locomotives for the new single-phase line from Dessau to Bitterfeld. Single-phase current at 10,000 volts and 15 cycles is supplied to the locomotives. One of the locomotives for passenger trains is equipped with a compensated series motor of the Siemens-Schuckert Company; another locomotive, for passenger trains, with the Winter-Eichberg motor. Details of freight locomotives are also given. By using motors the regulation of which is accomplished by displacement of the brushes the single-phase locomotive becomes equivalent to the three-phase and direct-current locomotives, even with respect to "specific output," since the weight of the electric equipment becomes so low as to yield a specific output of 26 hp per ton.—*Elek. Kraft. u. Bahnen,* May 24.

Gasoline-Electric Motor-Car.—G. Brecht.—An illustrated article on new gasoline-electric motor-cars in use by the Prussian-Hessian State railways. In the first cars installed it was found that when the car stopped the vibrations of the gasoline engine were unpleasant to the passengers. This trouble has been reduced by a simple arrangement by which the speed of the gasoline engine, which is normally 700 r.p.m., is reduced to from 200 to 250 when the car stops. The gasoline engine has a rating of 100 hp and is coupled to a 50-kw, 300-volt generator, which can give 66 kw for an hour. Each of the two series traction motors with interpoles is rated at 82 hp. The 70-volt exciter also generates the energy for lighting and for accessories. Emergency lighting is obtained by means of a storage battery.—*Elek. Kraft. u. Bahnen,* May 14.

Marine Propulsion.—In an article by H. A. Mavor on marine propulsion by electric motors, an investigation is made of a special case of marine propulsion where the existing method of driving is admittedly efficient and cheap. He shows that while the possibilities of economy are restricted there is still a strong case for electric methods. The logs of two voyages are used to illustrate the argument that the "load factor" is likely to be an important item in the consideration of economical working at sea as it is on land. In another article by H. T. Leake a new system of turbo-electric propulsion of ships is described. Ordinary three-phase generators and squirrel-cage motors are used, and speed variation of the propelling motors is obtained by varying the speed of the turbo-generators. To enable the motors to be reversed, use is made of braking drums, mounted on the turbine shafts, which may be described as a species of turbine designed to absorb the power instead of producing it. The general arrangement is shown in Fig. 1 for a ship with four propellers, the four motors being indicated by

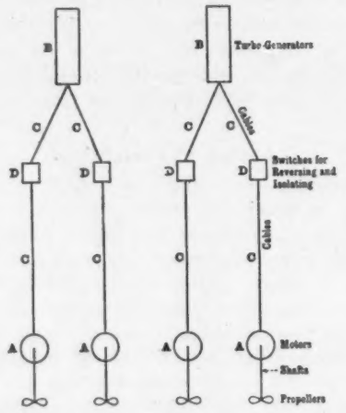


Fig. 1—Diagram of General Arrangement of Propulsion Machinery.

A. They are driven by two turbo-generators *B* supplying energy to the four motors through four independent lines of three-phase cables *C*. Each line of cable passes through a small reversing and isolating switch *D* which is inclosed in an iron case located in an accessible position in or near the engine-room. Each of the turbines is fitted with a very powerful brake, one form of which consists of some rows of stationary and moving blades so shaped and set that on turning steam into this part of the turbine sufficient resistance is offered to the rotation of the drum to reduce its speed quickly. The amount of steam which can be utilized in the brake is the same as is available for driving the turbine in the ordinary way, and as questions of economy do not arise, it is possible to obtain a very powerful braking effort with very little addition to the size and weight of the ordinary turbine. Assuming that it is desired to change from "full-speed ahead" to "full-speed astern," steam is shut off from the working portion of the turbine and admitted into the steam brake. The motion of the ship in the ahead direction operating through the propellers drives the motors as generators transmitting energy back to the generator, and thereby driving the turbine. The energy is absorbed in the steam brake, where any amount of surplus energy can be dissipated in a form which offers no difficulty in its disposal. The speed of the ship is thereby effectively and rapidly checked, until finally the speed of the generator and motors has fallen to a point at which the frequency is sufficiently low to enable the reversing switch to be operated without causing excessive current. Steam is then immediately shut off from the brake and simultaneously admitted into the working portion of the turbine. At the reduced frequency which the voltage applied to the reversed motors now has the motors are able to develop full-load torque with normal current without the need of rotor resistances, and consequently a powerful effort can be exerted to check completely the motion of the ship and start it in the reverse direction. The turbine gradually runs up to full speed, when ultimately the ship travels astern with the same full power available as for propulsion ahead. In order to illustrate the general nature of these operations a diagram is given in Fig. 2 which shows graphically the

general manner in which the various speeds, torques, etc., vary during the process of carrying out the order "full ahead" to "full astern." These curves are intended to be typical only, and are not to scale. In another article by W. P. Durtnall marine propulsion by the "paragon" system is discussed. After a brief reference to the conditions to be observed in marine propulsion, the author considers two cases in detail in which the effect is

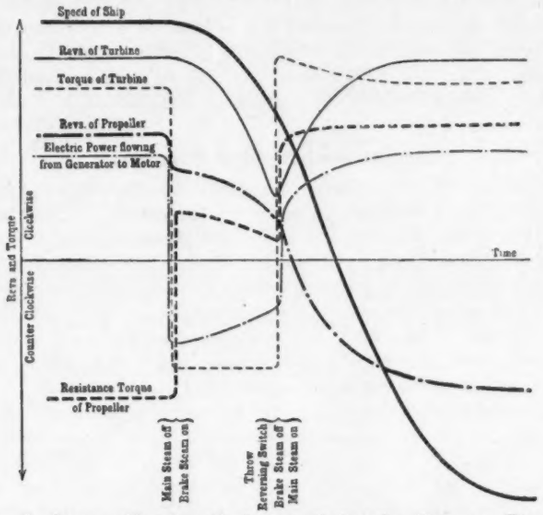

Speed of Ship
Revs. of Turbine
Torque of Turbine
Revs. of Propeller
Electric Power flowing from Generator to Motor
Revs and Torque Clockwise
Revs and Torque Counter Clockwise
Time
Resistance Torque of Propeller
Main Steam on Brake Steam off
Throw Reversing Switch
Brake Steam off Main Steam on

Fig. 2—Curves Showing Variation of Speeds, Torques, Etc., in Reversing Propelling Machinery.

estimated of replacing the usual steam drive by the "paragon" electric system. The first is the steamship *Lusitania*, in which, although the saving in weight of plant is not material, the saving in coal and wages is found to be considerable. The second case is that of a 5000-hp "tramp" steamer in process of conversion. W. B. Sillince discusses electromechanical propulsion with Diesel engines. After giving figures as to the economy of the Diesel oil engine and features of construction, the author describes its use at the present time in boats, and finally outlines the Mirrlees system of electromechanical propulsion. In this system, generators directly coupled to Mirrlees-Diesel engines are used. For speeds between full speed and half speed a combined friction and positive clutch couples together the engine and propeller shafts. For speeds below half speed the shafts are disconnected and the motors are used.—Supplement to Lond. *Electrician*, June 10.

Installations, Systems and Appliances.

Gas Plants and Electricity Stations.—G. DETTMAR.—A statistical article illustrated by diagrams on the effect which the erection of an electric station has on an existing gas plant in the same city. On the basis of German statistics he finds that in general the opening of an electric station has no detrimental effect on the gas works in cities having not over 30,000 inhabitants. It appears that both the gas plant and the electricity station develop evidently at the expense of kerosene lighting and by reason of the increased demand for light and motor service. The electric station offers to many inhabitants the first opportunity of getting a suitable motor service.—*Elec. Zeit.*, June 9.

Gothenburg.—E. WIKANDER.—The conclusion of his illustrated description of the electric station of the city of Gothenburg in Sweden. This new municipal station, which was erected in the years 1907 and 1908, supplies direct current at 120 volts, three-wire, in the center of the city and three-phase currents at 120 volts to the outlying districts. The new station is an enlargement of the existing municipal traction station and supplies energy directly to about two-thirds of the area, while the remaining third is supplied with energy from a motor-generator substation. The high-speed steam engines of the station are coupled to motor-generators which will be operated later on with energy transmitted from the Trollhättan Falls station, which is at a distance of 75 km. (45 miles). In order not to be forced to keep the steam engines always running, a reserve for the water-power is provided in the form of very large batteries. The maximum permissible load on the networks is 5500 kw.—*Elek. Zeit.*, June 9.

Electric Heating.—J. A. FLEMING.—In a lecture on electric heating and pyrometry, a review is given of different electric heating apparatus. In one type silundum rods are used as resistors—that is, carbon rods, the outer surfaces of which have been covered with a layer of carbon silicide. In another type wire is enclosed in quartz tubes. In another one the induction principle is employed. In still another one wire is laid in a special groove in a refractory metal. Still another series of heaters consists of a double-walled vessel in the inner space of which is located a band of high-resistance material insulated with mica. Some data are given on the power consumption of such apparatus and it is stated that under the best conditions, with gas at 68 cents per 1000 cu. ft., the expense of raising one pint of water from 60 deg. Fahr. to 212 deg. Fahr. is about 0.05 cent, but ordinarily three times as much gas is used, the cost being 0.15 cent. In this case the cost would be the same as with a first-class electric heater, supplied with energy at 2 cents per kw-hour. The lecturer suggested that in view of this comparison the electrical supply companies in the electric heating might find a relief from the pronounced peak of their load diagram. What is required is a load which will not come on at the same time as the lighting load, and this can be found if the great hotels and the like will provide for the electrical heating of their hot-water supplies. To this end the water should be confined in a well-lagged system, so that the heating can be effected slowly and with a small amount of power long continued. In this way an equivalent of thermal storage would be obtained, which would greatly increase the load factor. In the Therol heater the water flows through a spiral pipe cast in the walls of a cast-iron vessel which serves as the receptacle for the heating unit. The water, after passing through the tube, is stored in an outer jacket surrounded by an insulating layer of magnesia. The use of electricity for heating the air in houses and buildings was also touched upon. The author expressed the belief that until the price of electric energy falls there is not much prospect of the adoption on a large scale of electricity for domestic heating. So far as cooking is concerned, much will depend upon the durability and cost of the appliances.—Lond. *Engineering*, June 10.

Electricity on Ships.—A. P. CHALKLEY.—An article on the use of electricity on ships. It is pointed out that there are two tendencies at the present time in regard to the use of electricity on board ship; namely, either to use it for all purposes, or to apply it to every purpose except that of propulsion. The possibilities of the Diesel engine in this connection should be borne in mind. Producer-gas plant has also been suggested, but the future in this line seems to be doubtful. On the other hand, the position of the turbine is assured. The standard voltage shows a tendency to rise, and there is much to be said in favor of alternating current in preference to continuous. A marked advance may be expected in electrical steering gear. Generally speaking, it may be said that the outlook for electricity on ships is very promising.—Supplement to Lond. *Electrician*, June 10.

Evolution of Electrical Engineering in the Navy.—An article in which the progress made in the employment of electrical apparatus in the navy from the earliest days is discussed, stress being laid on the difference in the conditions which exist on board ship compared with those on shore. The general layout of the electrical equipment and the way in which it is maintained is then described, while the methods employed in lighting the ship and the directions in which the electric motor is employed on board a modern battleship are also considered.—Supplement to Lond. *Electrician*, June 10.

Switchboards on Warships.—A. G. COLLIS.—The author summarizes the former and present specifications of switchboards for warships and criticises the lack of uniformity in design. It is essential that manufacturers entering this field of work should specialize. It is also highly desirable, he urges, that parts of gear should be interchangeable even if made by

different makers. There are also other descriptive articles on large switchboards for ship work on ironclad fused switches, etc. Supplement to Lond. *Electrician*, June 10.

Electric Steering Gear.—A. P. Chalkley.—A number of systems of electric steering are described, and in particular those of the Union Electricitäts-Gesellschaft; Pfatischer (in use in this country); Siemens Brothers; Clarke-Chapman & Company; and Brown Brothers (the Brown-Haigh system). The article is illustrated by diagrams. The same issue contains an illustrated description of the Richards-Evershed system of helm indicators.—Supplement to Lond. *Electrician*, June 10.

Electric Service in Agricultural Districts.—K. Krohne.—An article giving figures on the cost of using electric energy for various purposes in agriculture, especially for plowing and thrashing. An electric plow of 40 hp costs $8,750, and the yearly cost of operation, including interest, amortization, repairs, wages, etc., is given as $2,258. Figures are also given on electric thrashing.—*Elec. Anz.*, May 29.

Austria.—E. Honigmann.—A continuation of his statistical article on the electrical industries in Austria in 1909, giving diagrams and numerous statistical tables on the imports and exports of electrical machinery, apparatus and appliances from 1907 to 1908.—*Elek. und Masch.* (Vienna), May 29.

Wires, Wiring and Conduits.

Wiring of Ships.—G. Austin.—A long and fully illustrated article. After enumerating the uses to which electricity is put on board ship and the various circuits that are desirable, the author discusses the question of the most suitable voltage, and the various systems of wiring that may be used—namely, single wiring, concentric and double wiring. The wires may be protected by wood casing, tubes, lead sheathing or armoring. Twin cable has much to recommend it. The insulation of wiring is rendered difficult by condensation and by the inevitable presence of salt. Careful erection is most important. Distribution may be on the system in which each lamp has its own fuse, or on that in which each group has a fuse; the latter appears to be sufficient. Owing to the special conditions, bell wires, as well as those for supply, should have good insulation. The article concludes with a reference to sundry applications. There are also other articles on marine cables on board ship, tinned tube wiring for ships, ship wiring with key spring conduit, etc.—Supplement to Lond. *Electrician*, June 10.

Bare Aluminum Cables and Wires.—H. M. Hobart.—A very long and detailed serial illustrated by diagrams giving a full comparison of aluminum and copper lines. Conductivity, cost, weight, sag, stress, windage, etc., are all made the subject of curves and calculations. The design and strength of steel towers are discussed as well as jointing of aluminum and several other points.—*Elec. Times* (London), March 24 and 31 and April 7, 14 and 21.

Determining the Cross-Section of Conductors.—S. Edell.—An article giving formulas and a diagram permitting the easy graphical determination of the copper cross-section of conductors for making connections to three-phase induction motors.—*Elek. Anz.*, May 29.

Electrophysics and Magnetism.

Direction of Motion of an Electron.—R. T. Kleman.—An abstract of a paper on the direction of motion of an electron ejected from an atom by ultraviolet light, read before the Royal Society in London. Experiments were carried out to see whether the cathode radiation from substances exposed to ultraviolet light moved initially in the direction of propagation of the light. The amount of cathode radiation from a platinum film deposited on a quartz plate in a discharged tube was measured with the film facing the source of ultraviolet light, and with it facing in the opposite direction. It was found that if the intensity of the pencil of light used was denoted by unity, the intensity of the light after passing through the quartz plate and film was 0.55; and if the intensity of the cathode radiation from the film when it faced the source of light was denoted by unity, the intensity of the radiation when the film faced in the opposite direction was 1.15. Since the intensity of the light decreased as it passed through the quartz plate and platinum film, it followed that the larger leak in the latter case than in the former would not be obtained if the cathode rays were ejected equally in all directions, but might occur if they had a component in the direction of propagation of the light.—Lond. *Electrician*, June 10.

Brownian Movements.—J. Perrin.—The first part of an article on the Brownian movements which the author considers to reveal the real nature of what is called a liquid "in equilibrium." In reality, the whole liquid is in agitation and it is only a "mean equilibrium" which is observed.—*La Lumière Elec.*, June 4.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—W. Holwech.—While the fixation of nitrogen by means of the electric arc has been considered to be essentially a thermal phenomenon and while this hypothesis seems to be correct for high temperatures, there is also formation of nitrogen oxides at lower temperatures by an effect which appears to be rather specifically electric instead of thermic. The author has made experiments with a short direct-current arc with a hot cathode and a cold anode and produced as much as 80 grams of HNO_3 per kw-hour. The shortest arc yields the highest concentrations at minimum speed of the air, the maximum concentrations being 9 per cent of NO in air. In an arc of which the anode is cold and the cathode is hot, the electric field intensity (voltage drop per unit of length of electric line of force) is nevertheless constant with the exception of the immediate neighborhood of the two electrodes. The higher the voltage drop per unit of length the greater is the output of nitrogen oxide and the concentration which can be obtained as long as the temperature of the arc is not too high. If the temperature of the arc is increased, the thermic phenomenon hides the electric one and the maximum concentration which can be obtained decreases. In the short arc of the author the voltage drop per centimeter was between 100 and 200. In the commercial furnaces for fixation of atmospheric nitrogen used in practice, the thermal phenomenon is an important one, while the shorter arcs of the author seem to favor the specifically electric formation of NO, since in his requirements the temperature was so low that the points of the finest iridium wire held in the arc did not soften.—*Zeit. f. Electrochemie*, June 1.

Electric Furnaces and Electric Heating.—J. A. Fleming.—The first of two lectures on electric heating and pyrometry, in which the author gives some notes on different types of electric furnaces for different purposes and also discusses electric heating (see abstract above under Installations). Several diagrams of different types of electric furnaces are given.—Lond. *Engineering*, June 10.

Units, Measurements and Instruments.

Mechanical Equivalent of Heat.—Revised proposals of the German Association of Electrical Engineers which are being made in agreement with several other German engineering societies. They are as follows: The equivalent of the 15 deg. calory is 4.189×10^7 ergs. The mean 0 deg. to 100 deg. calory is equivalent to the 15 deg. calory. The numerical value of the gas constant is 8.316×10^7 if the energy is measured in ergs and 1.985 if the energy is measured in gram calories. The international joule is equivalent to 0.23865 calory, the 15 deg. calory being meant. The 15 deg. calory is equivalent to 427.2 kg-meters if the value of gravity at 45 deg. latitude and at sea level is taken. A short discussion of the above principles is added.—*Elek. Zeit.*, June 9.

Unit of Conductance.—A revised proposal of the committee of the German Association of Electrical Engineers made in agreement with various other German engineering societies. The reciprocal of resistance is conductance (Leitwert), its unit in the practical electromagnetic system of units is called the siemens (which would be the same as mho in this country) and for notation the letter *S* is used. The reciprocal of the specific resistance is conductivity (Leitfähigkeit) or specific

conductance (spezifischer Leitwert). A discussion of these proposals is added.—*Elek. Zeit.*, June 9.

Motor Meters.—WAGMÜLLER.—P. May has recently criticised the use of hot wires for oscillating the brushes in watt-hour and ampere hour meters on the ground that there is danger of overloading the hot wires. The present writer shows that it is very easy to protect the hot wire against overloading. The

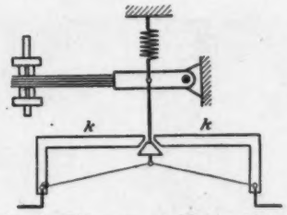
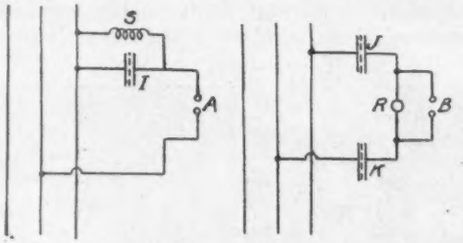


Fig. 3—Diagram of Motor Meter.

arrangement is shown in Fig. 3. The two pieces *kk* are so arranged that if the current in the hot wire increases beyond the permissible value the two pieces *kk* are connected together by the contact piece between them. In this way the hot wire is short-circuited and protected against destruction.—*Elek. Zeit.*, June 9.

Telegraphy, Telephony and Signals.

Transmission of Signals by High-Frequency Currents.—L. NEU.—In long-distance transmission systems it is of importance to provide communication between the different stations. The erection of a special telephone line for this purpose would be expensive. The author, therefore, proposes to use the transmission line itself for the transmission of signals. The principle of the scheme is shown in the adjoining illustrations. Fig. 4 is the transmitting station, *A* is a spark gap with adjustable distance between the electrodes; it is of the ordinary form employed in wireless telegraphy. The connection of the transmission line is as illustrated, *S* being an inductance coil and *I* a condenser. *I* prevents the passage of the low-frequency current of the line, while *S* does not permit the high-frequency currents to pass. The receiving station is shown in Fig. 5, where *B* is an air-gap, and *J* and *K* are two condensers, which are intended to permit the high-frequency currents to pass, while the low-frequency currents of the transmission line can-



Figs. 4 and 5—Transmission of Signals by High Frequency Currents.

not pass. *R* is a hot-wire relay or some other kind of a relay which on the arrival of high-frequency currents closes an auxiliary circuit containing a battery which actuates a bell. A signal is transmitted by first bringing the two electrodes of *A* at the transmitting station nearer together until a spark passes. The oscillations pass over the line and a spark passes at *B* in the receiving station. The duration of the spark is the same as the duration of the spark at the sending station. It is, therefore, easy to transmit signals of adjustable time duration, such as Morse's signals, over the line.—*Elek. Anz.*, June 2.

Miscellaneous.

British Institution of Electrical Engineers.—An account of the recent annual meeting. The number of members is now 6222, compared with 6097 in the previous year, and is composed of 7 honorary members, 1173 members, 2629 associate members, 938 associates, 1370 students and 105 foreign members.—Lond. *Electrician*, June 3.

New Apparatus and Appliances

POLYPHASE INDUCTION MOTORS.

The Holtzer-Cabot Electric Company, Brookline, Mass., has brought out a line of polyphase induction motors in the design of which is incorporated the long experience of the company in building a particularly efficient line of single-phase motors. The polyphase motors are generously designed, and their overload capacity, starting torque, bearings, etc., are more liberal

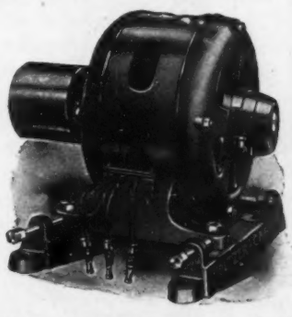


Fig. 1—10-Hp Three-phase Motor.

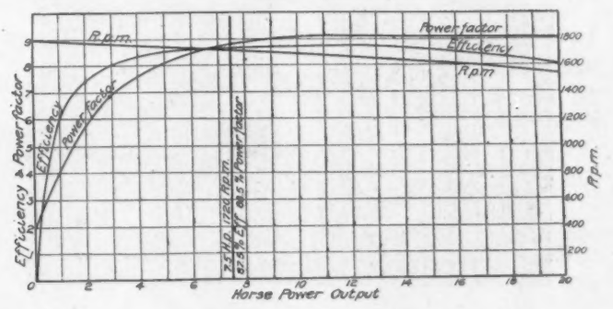


Fig. 2—Characteristics of 10-Hp Three-phase Motor.

than called for by ordinary practice. The manufacturer states that the motors have been designed to start and carry heavy overloads, and at the same time to possess good efficiencies and power-factors. Close attention to details is said to be responsible for these desirable features. The characteristics of this type of motor are shown in Fig. 2. Particular attention has been given to produce rugged, high-efficiency motors of moderate over-all dimensions, so as to enable them to be used in places where space is limited. In mechanical construction the machines follow the conventional design which experience has proved best suited to polyphase apparatus. By the use of revolving vanes good ventilation, and therefore cool running, is obtained. Partially closed slots are used in all of the motors, so as to obtain high power-factor and good starting performances; the slot opening being left large enough, however, to permit the easy removal of coils in case of trouble. The motors are built for constant speed in sizes from ½ hp to 30 hp, for all commercial voltages, frequencies and speeds. Compensator starters are ordinarily furnished with the larger machines, although where the starting torque required is not great primary resistance starters may be used.

TELEPHONES IN AN ELECTRICAL SUPPLY FACTORY.

To keep the departments of a well-organized business in constant touch with one another and with the directing heads, and to place the superintendent within instant access of all of his subordinates, is the work of the interior telephone system. The efficiency of the telephone in helping out the systematic

Fig. 1—Telephone on Superintendent's Desk.

regulation of daily routine is attested to by many manufacturing concerns. The inter-phones shown in the accompanying photograph were installed recently in the plant of Edwards & Company, manufacturers of electrical specialties, at 140th and Exterior streets, Borough of the Bronx, New York. A 10-station system answers the requirements of this service in a four-story building. With the aid of the inter-phones, which are automatic in their operation, the manager is able to reach any of his departments at once, without waiting for a central to make connections or taking the time to climb the stairs. Previous to the installation of the inter-phones considerable

Fig. 2—Inter-phone in Woodworking Shop.

time was devoted to the stairways. On the first floor of the Edwards factory are situated offices, shipping room and paint shop. Three stations have been installed on this floor, and it can easily be seen how the requirements of every-day office work keep these inter-phones busy. While the manager is at his desk every department of the business is literally as near to him as the keyboard on his inter-phone set. The second floor is given over entirely to the machine shop, and directly above is the large assembling and testing room. From the superintendent's desk at one end of this room to the offices on the first floor is quite a trip, but the inter-phone brings the two centers into immediate contact. There are telephones also in the wood shop and stockroom on the fourth floor. Two of the accompanying illustrations show the manner in which the inter-phone sets have been placed in the rooms. The iso-

Fig. 3—Stock Room Installation.

lated position of these two departments on the top floor makes this means of connection of extreme importance. The inter-phones were made and installed by the Western Electric Company. Conditions at the Edwards plant may be taken as typical of a great many other establishments for which a system of interior telephones is well adapted. Merely pressing a button opposite the nameplate of the station desired places one in communication with the called party, without the medium of an operator.

WATERPROOF JUMP-SPARK IGNITION SYSTEM.

The principle of the "Perfex" jump-spark ignition system manufactured by the Electric Goods Manufacturing Company, of Canton, Mass., is that of low-tension distribution and high-tension ignition. The induction coil is combined with the spark plug so that there are no secondary wires. The spark-plug is readily detached from the coil and is equipped with a renewable porcelain plug. A small condenser box contains a polarity-changing master vibrator, which, being changed end

Fig. 1—Induction Coil and Plug.

Fig. 2—Vibrator and Condenser Box.

Fig. 3—Detached Plug and Removed Porcelain.

Fig. 4—Detachable Current-Reversing Vibrator.

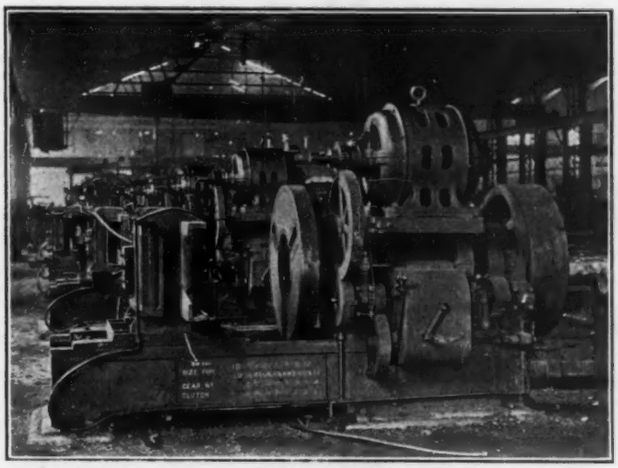
for end each day, eliminates pitting troubles at the contact points. The one vibrator suffices for six cylinders as well as for one cylinder, and any timer that will operate the ordinary coil system can be used in connection with the "Perfex" system by the addition of a few feet of primary wire. It is claimed that the spark gap is unaffected by water and that the engine can be started with wet spark plugs.

MOTOR-DRIVEN PIPE-THREADING MACHINE.

The motor driven pipe threading machine shown by the accompanying illustration is one of several recently installed by the Stoever Foundry & Manufacturing Company of Myerstown, Pa., at the pipe mill of the Spang-Chalfant Company, Sharpsburg, Pa. The capacity of the machine is from 4 to 12 in. inclusive. The installation is of especial interest in that it is the fastest machine for threading or cutting pipe on the market, the rate of threading being 28 feet per minute, a very fast speed for a tool of this size.

The machine is driven by a Westinghouse squirrel-cage induction mill motor, which has the rugged construction and the general reliability required for such service. The normal rating of the motor is 10 hp, and the full load speed is 875 r.p.m. on a three-phase, 25-cycle, 200-volt circuit. Squirrel-cage induction motors of suitable design are especially appropriate for this class of service, since the speed is constant and there are no sliding contacts. The motor shown is said to be the first squirrel cage induction motor designed especially for heavy mill service; the only wearing parts are the bearings, which are very large, rigid and self-oiling, and capable of maximum service. The motor is started by means of a Westinghouse auto-starter.

The pipe threading machine has ten speeds; the gear box gives five changes, and a double train of gears outside of the box gives two speeds for each one in the box. All of the gears



Motor-Driven Pipe-Threading Machine.

are made of carbon steel castings and are fitted with bronze bushings. The gears that are subjected to the most wear have case-hardened teeth. All the gears run in oil. A number of changes in speed can be made without stopping the machine. The machine can also be started or stopped by means of a clutch on the operating side of the tool. The gearing is on the outside of the machine and accessible to the operator. An internal driving gear placed in close to the body of the machine is used on the rear of the machine.

There are provided two gripping chucks of unusually heavy design, made in one piece without any separate parts or faceplates. Each chuck has three independent jaws operated by powerful screws. These jaws are made of steel and are equipped with hardened steel plates for holding the pipe.

The die head is of the sliding or floating type that allows for any eccentricity in the pipe. The die head can be pushed to one side and pipe cut off at a distance of three inches from the face of the front gripping chuck. This type of head permits inserting the pipe from the front or rear of the machine without injury to the dies. Rounding blocks are provided for rounding the pipe before it is threaded.

The oil pump on the machine is of the geared type and is driven direct from the constant speed shaft. Valves are placed at both the die head and the cutting off tool to regulate the supply of oil at these points. All surplus oil flows back into the reservoir in the bed of the machine through a relief valve.

All of the bearings of the pipe threader are provided with long and deep receptacles for holding lubricating wool and oil so that the machine is operated at all times with perfect lubrication.

TWO-BOLT GUY-WIRE CLAMP.

W. N. Matthews & Brother, of St. Louis, Mo., have taken up the manufacture and sale of the Way, two-bolt, guy-wire

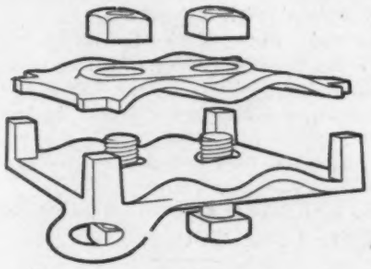


Fig. 1—Guy-Wire Clamp.

clamp. This device, as will be seen by reference to the engravings, is composed of two galvanized malleable iron plates

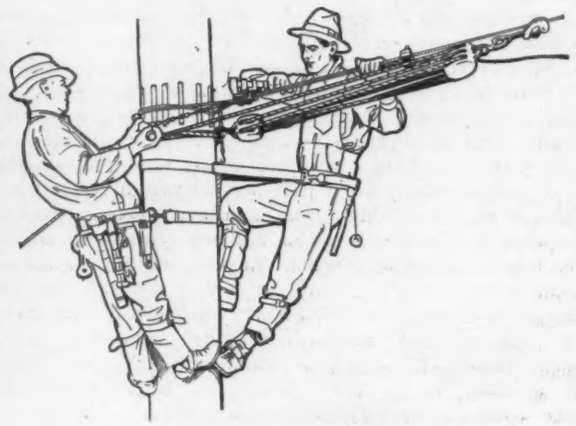
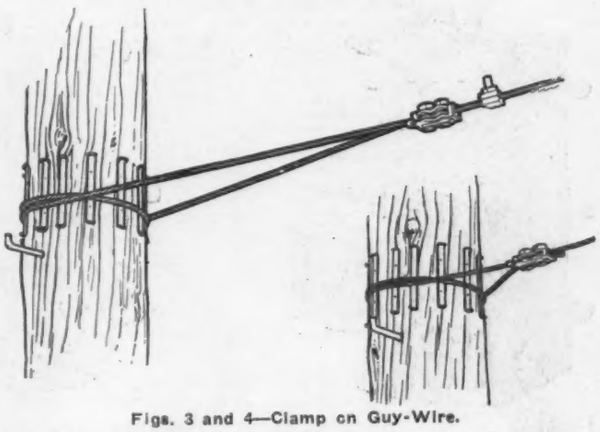


Fig. 2—Tightening Clamp.

and two 5/8-in. machine bolts. One plate has an ear cast on it and the other has a lug cast on each of the four corners. The



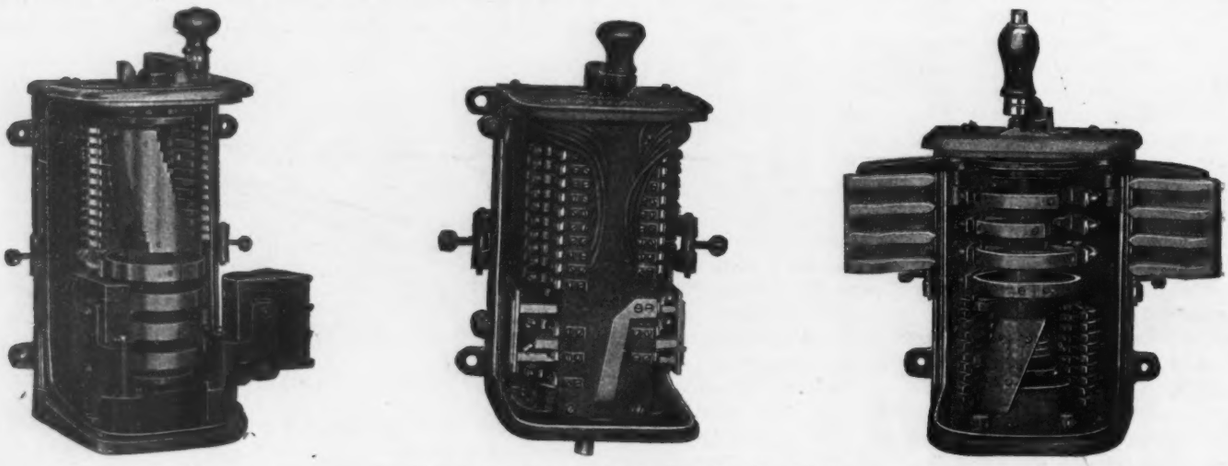
Figs. 3 and 4—Clamp on Guy-Wire.

clamp complete weighs 1¾ lb. By its use the hammering necessary when installing the standard three-bolt clamp becomes unnecessary and the nicks in the messenger wire and damaged

galvanizing due to misdirected blows are unknown. In the standard clamp the guys not infrequently jump out. This annoyance is obviated in the clamp illustrated herewith by the four lugs cast on one of the plates. These keep the guys in place and because of them the clamp can be put on loosely and drawn into final position by means of the chain lever without any possibility of the guy wires becoming dislocated. The ear on one of the plates is used as a means of attachment for the hooks of the chain lever. If the two nuts are fastened tightly the clamp cannot slip and the manufacturers claim that it has been demonstrated that one of the two-bolt guy-wire clamps will hold more than two standard clamps. The clamp is shown on a guy wire with nuts screwed on loosely and a temporary clamp back of it to hold the guys together until the clamp is fastened. Fig. 2 shows the linemen tightening the clamp after it has been pulled to position by means of a chain lever. The completed job is illustrated in Fig. 4. It is said that two linemen can complete the task in less than three minutes.

DRUM TYPE CONTROLLERS FOR MACHINE TOOLS.

For the control of machine tools driven by electric motors where the starting service is frequent or of a severe nature, drum type controllers are preferable. The General Electric machine tool controllers have been designed with many special features to meet the conditions of modern shop practice. Among these may be mentioned substantial removable barriers between the fingers wherever required; magnetic blow-outs for all equipments for 500-volt service or for large currents at lower voltages; special screws to hold the segments with heads slightly counter-sunk below the surface so as to prevent their wearing with the segments, and tapered at such an angle as to prevent their loosening; sheet iron covers lined with asbestos to protect live parts from dust and mechanical injury, and eliminate danger of shock from accidental contact; terminals and other parts readily accessible, and field control with adjustable fingers similar in design to the fingers for the armature circuit. Where it is desired to obtain overload and no-voltage protection in connection with drum controllers, the company has designed a panel consisting of a circuit-breaker, a single-pole contactor and two fuses, all mounted on a slate base; the latter being provided with feet to make a neat installation. The circuit-breaker and fuses afford the overload, and the contactor the no-voltage protection. The operation of these panels depends essentially upon an electrical interlock between the no-voltage release and the drum controller. When the controller handle is moved to the first point the coil of the contactor is energized, closing the contactor and completing the armature circuit. As greater force is required to close the contactor than to hold it closed, when the controller handle is moved beyond the first point, a high resistance resistor is inserted in series with the contactor coil to prevent the contactor from closing in case of a restoration of voltage after failure, until the controller is turned back to the first point. This device is designed for both shunt and compound-wound motors.



Figs. 1, 2 and 3—Controllers for Machine Tools.

PORTABLE ELECTRIC LAMP.

The L. A. Williamson Company, of Boston, Mass., has brought out a portable electric lamp possessing many features of interest. Briefly described, the "Flexilyte" consists of a case containing about 15 ft. of lamp cord, an attachment plug and a crank for winding the cord on the center portion, which is a lamp socket. The cord can be unwound to any desired length and held fast by means of a sliding catch. Any standard incandescent lamp fits the socket, so that the lamp may be transferred from any fixture to the "Flexilyte"; the attachment plug being secured into the fixture socket from which the bulb has been removed. The case is designed so it can be placed on a polished surface without marring or scratching it.

Figs. 1 and 2—Portable Electric Lamp.

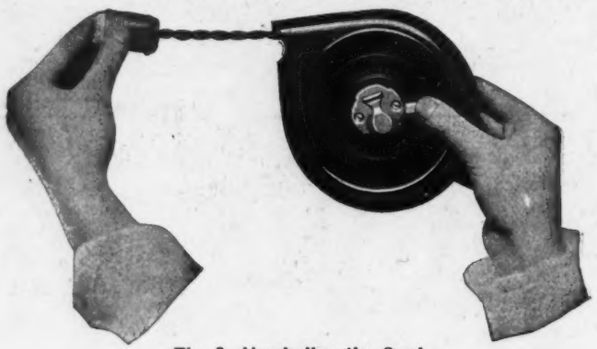
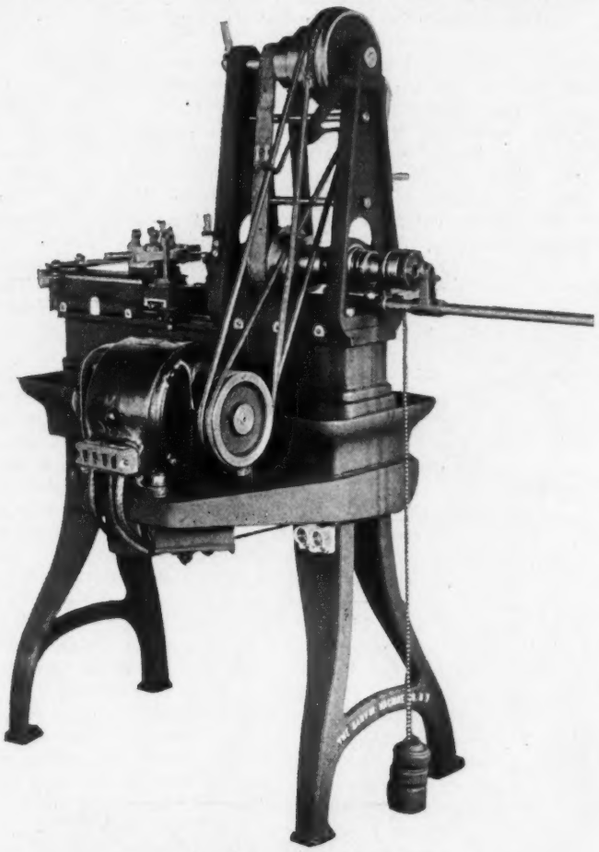


Fig. 3—Unwinding the Cord.

MOTOR-DRIVEN SCREW MACHINE.

The accompanying illustration shows a standard screw machine, as regularly made by the Garvin Machine Company, of New York City. It has automatic wire feed and none of its numerous advantages are impaired by the attachment of the motor drive. The manufacturer's idea in using the regular stock machine for attaching motor drive is of twofold benefit; the principal one being, promptness in the execution or orders, and the second, the moderate cost at which one can secure a motor-driven, portable machine that can be set anywhere in a factory to suit conditions. The main belt can be an endless belt, although in practice it is found that the full power of the machine is easily derived from the fact that the upper cone, which runs loose on the shaft, is used also as a tightener, having eccentrics on both ends, which keeps the main belt up to good adjustment and allows for quick slacking for change of speed. The ½-in. belt used, straight and crossed, is under control of the shipper handle shown on the right of the upright. The belts run to a system of three grooved pulleys overhead; the outside ones being loose pulleys, and the center one the tight pulley. Abundant facilities are provided for oiling through the

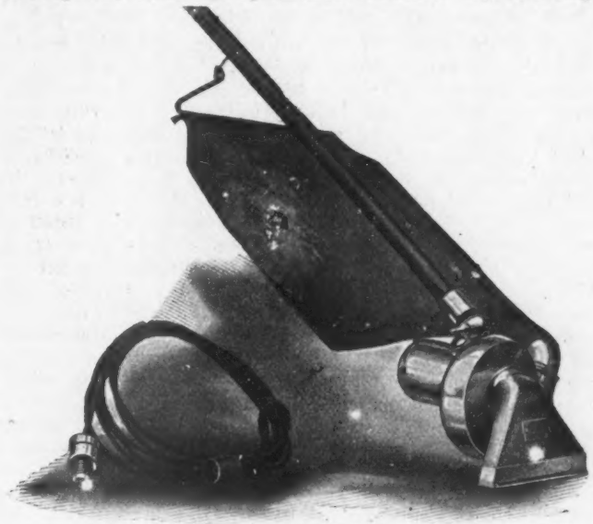


Motor-Driven Screw Machine.

inside of the upper shaft. The machine is started and stopped from the front side, convenient to the operator, and weighs complete, as shown on skids, 600 lb. A ½-hp motor is used to drive the machine, the motor running at 1600 r.p.m. The machine will take a ⅝-in. rod through the wire-feed spindle, and the length of cut is 3 in.

PORTABLE VACUUM CLEANER.

The Eureka Vacuum Cleaner Company, Detroit, Mich., has brought out an electric vacuum cleaner possessing several features which are exclusive with the machine. The motor, for instance, is on the under side of the cleaner, where it is out of the way and protected from knocks and injuries. It is of such size that it can get under any article where the space is not less than 7½ in. in height. The energy is controlled at the end of the handle, and not by a switch on the motor, so that it is not necessary for one to stoop over to start and stop the machine. There are only three parts to the actual cleaning apparatus: The motor, the fan and the dust bag. Attachments are provided for use on hard-wood floors or wood work in general, for draperies, walls and upholstered furniture. By reversing

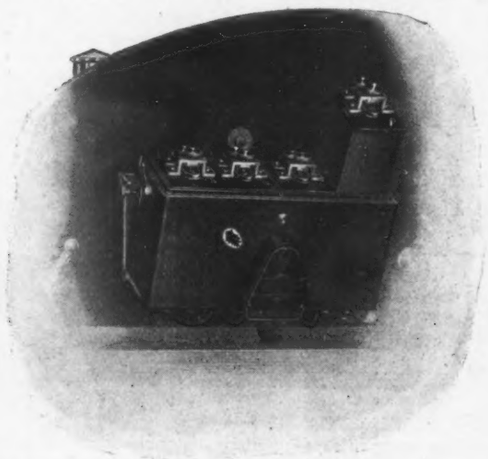


Portable Vacuum Cleaner.

the hose attachment a blower is secured for drying hair, blowing dust from between radiator sections, etc. The hose attachment does not have to be used for cleaning carpets; the cleaner being employed direct. A universal motor is used so as to render the device applicable for either alternating-current or direct-current circuits. The machine weighs 9¾ lb., and the power consumption is said to be 125 watts per hour.

HINGE BRACKET SPARK COIL.

The Connecticut Telephone & Electric Company, of Meriden, Conn., has placed on the market a new type of hinge bracket



Hinge Bracket Spark Coil.

spark coil. This is especially designed for cramped dashes of automobiles where it is not possible to remove the units of the coil without in many cases taking the coil off the dash. With this hinge bracket it is possible to swing the coil back from the dash in such a position that the units can be easily removed, thus taking advantage of one of the most important points in the construction of Connecticut coils, which are interchangeable without touching a wire connection.

Industrial and Commercial News

The Week in Trade.

GENERALLY speaking, conditions of trade were improved last week in most sections of the country. Retail trade and crop reports were better, due, no doubt, to the arrival of the long-delayed, seasonable summer weather. At best, however, the retail business is not up to expectations, although almost all over the country price reductions and bargain sales have been resorted to to stimulate buying. The Northwest showed the least improvement last week, that section being still in doubt as to the condition of spring wheat which has been retarded by long-continued dry weather. Wholesalers and jobbers report that there is a trifle more confidence being shown in ordering for fall, based on the improved crop outlook. It is not by any means heavy, as yet, and in practically every line price concessions are demanded. The general reductions in all lines of cotton goods have brought considerable response in the way of increased orders. In industrial lines there is little evidence of increased activity. The iron trade is still fairly lively, but prices for pig are lower and there is less optimism expressed than heretofore, as to the fall outlook. Some orders are being received at the mills for light rails, and it is reported that a leading trunk line which has recently been successful in placing a bond issue is about to place a large order for steel cars and locomotives. Current orders for wire products are small, and brass and copper products are in only moderate demand. All textile mills, both cotton and woolen, are curtailing output, and are reducing prices to extremely narrow margins. In spite of the easy money market in all sections of the country, collections do not show much improvement. Outside merchants are still slow to pay. Business failures for the week ended June 23, as reported by *Bradstreet's*, were 187, as against 178 the previous week, 223 in the same week in 1909, 258 in 1908, 150 in 1907, and 146 in 1906.

The Copper Market.

FOLLOWING the heavy sales of electrolytic copper to the domestic consumer a fortnight ago, there was some strength developed in the copper market during the first few days last week. This induced many independent producers of copper to attempt to make sales at slightly advanced prices. This attempt was more or less disastrous, as there was much more copper offered than consumers desired. An unsettled feeling was developed, and when it became known that quite a sharp reduction in the price of lake copper had been made by the Calumet & Hecla Company prices declined and the situation was extremely weak. A very small volume of business was transacted in the domestic market, and what was done was principally for July, August and September delivery.

Standard copper.	Bid.	Asked.	Settling price.
Spot	11.95	12.25	.....
June	11.95	12.25	12.10
July	11.95	12.20	12.07½
August	11.95	12.20	12.07½
September	11.95	12.20	12.07½

The London market, June 27, was as follows:

	Noon. £ s. d.	Close. £ s. d.
Standard copper, spot	54 13 9	54 11 3
Standard copper, futures	55 7 6	55 3 9

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	12.05c
London, spot	£62 0 0	£54 2 6
London, futures	65 18 9	54 17 6
Best selected	65 10 0	59 0 0

The selling companies seemed particularly anxious to dispose of copper for July delivery, and were not inclined to make concessions in prices on that account. Fractional premiums were required for forward shipments. Unless some heavy buying takes place before July 1 the report of the Copper Producers' Association will make an extremely unsatisfactory showing from a statistical standpoint. The production is continuing at record figures, and the takings of consumers for the month will not be very heavy. In the mean time imports are far beyond the average for any other year. The present indications are that the total deliveries for the month to domestic consumers and for export will be less than 100,000,000 lb., while the production will probably exceed 120,000,000 lb. Local consumers are not aggressive in their efforts to procure copper, and certain manufacturing concerns that have heretofore purchased in lots running from 10,000,000 lb. to 20,000,000 lb. are now buying from 1,000,000 lb. to 5,000,000 lb. at a time. The market in London has been particularly weak during the past ten days, and, although prices have declined, sales to actual consumers have been very light. Exports for the month, including June 27, amounted to 17,559 tons. The imports for the month have been 8525 tons of copper, 410 tons of matte and 5810 tons of ore. The daily call on the Metal Exchange June 27 quoted standard copper as per the accompanying table.

Industrial and Commercial Notes.

New Industrial Power Plant in Canton, Ill.—The Parlin & Orendorff Company, of Canton, Ill., manufacturer of agricultural implements, will erect an entirely new power plant in a new power house, to supply electrical energy to operate the various departments of its large establishment. Electric drive will be used throughout. A contract has been closed for the purchase of a 2000-kw turbo generator, consisting of a horizontal Curtis steam turbine and a General Electric 440-volt, two-phase alternator. This will be the principal generating unit in the new plant, which will also contain surface condensing apparatus, with a cooling tower, and four new Heine water-tube 500-hp boilers. The old plant consists of about 700 kw in electric generators, and 1800 hp in boilers. The boilers in the old plant will be transferred to the new one, but otherwise the old plant will be dismantled. The boilers will be equipped with chain grates made by the Illinois Stoker Company, of Alton, Ill. The plant is laid out so that it is capable of extension. About 100 electric motors, nearly all of the induction type, will be required. These motors range from 2 hp to 100 hp in rating. They will drive various machine tools. C. A. Chapman, Inc., of Chicago, is the consulting engineer for the Parlin & Orendorff Company.

Electricity for Mexican Mines.—The mines in the Elzathan and Hostotipaquillo district of Mexico will soon be supplied with all the electrical energy necessary for their operation. Machinery for generating 8000 hp has been delivered at the site of the Puente Grande hydroelectric plant on the Santiago River, near Guadalajara. This machinery was purchased from the contracting firm of Siemens-Schuckertwerke, of Berlin. There have already been delivered two complete 4000-hp units, and another smaller unit will soon be received. The power house and penstock will be ready as soon as the turbines are set up. This plant is being erected by the German firm under contract with Manuel Cuesta Gallardo, a Mexican capitalist, who will construct a long transmission line which will supply energy for the mines and plantations of that district. When completed the entire property will become a part of the merger of interests of which the Guadalajara Railway, Light & Power Company is a principal feature. The merger will be known as the Chapala Hydroelectric & Irrigation Company. A line of steel towers has already been erected over the main transmission route, and side lines will be run to different distribution points as rapidly as contracts are made.

Wabash-Pittsburgh Terminal Electrification.—Plans are being drawn for the partial electrification of the Wabash-Pittsburgh Terminal Railway and the West Side Belt Line at Pittsburgh. It is proposed to electrify the terminal road as far as Kickory, 21 miles, and the West Side as far as Braceton, about 12 miles. If the plans for electrification cannot be successfully carried out, the management of these lines will probably replace the steam locomotives now in use with gasoline motor cars. It is believed that the sparsely settled territory along these lines will be built up by the more frequent operation of trains.

Michigan Electric Welding Company.—The Agnew Electric Welding Company, of Detroit, has been purchased by interests allied with the Electric Welding Products Company, of Cleveland, and the former name will be changed to Michigan Electric Welding Company, with the following officers: President, C. E. Thompson; vice-president, J. A. Krider; secretary and treasurer, R. K. Loofburrow. The concern makes a specialty of automobile parts.

Traction Development in the Carolinas.—If present plans are carried out, the Piedmont section of the Carolinas will have soon an interurban trolley system equal to anything of its kind in the United States. It is understood the Dukes are backing the project, which will require $5,000,000 to carry to completion. The Dukes propose to handle the bonds for half this amount, and to contribute to the remaining funds necessary on condition that cotton mills and other corporations and individuals along the proposed route subscribe to the project. It is stated that already $600,000 has been subscribed, and that the balance will be forthcoming. The line proposed will pass through Greenville, Anderson, Spartanburg, S. C., and Kings Mountain, Gastonia, Mount Holly, Charlotte, Concord, Salisbury, Lexington, High Point and Greensboro, N. C., with a likelihood of later extensions in various directions where the Southern Power Company lines run into the two States. W. S. Lee, of Charlotte, is president of the company, and J. P. Cook, of Michigan, has been elected general manager of the Greenville, Anderson & Spartanburg Company. The two companies which will construct the lines are known as the Piedmont Traction Company of North Carolina and the Anderson, Greenville & Spartanburg Railroad Company, of South Carolina. The road will be operated under one company, probably the Piedmont Traction Company. Work has already commenced on the line. The road will handle freight and passengers, and its completion will mark the beginning of a new industrial era in the Carolinas.

American Telephone & Telegraph Company.—It is now practically admitted that the American Telephone & Telegraph Company is gradually removing its headquarters from New England to New York. It is said that the executive offices will soon be located exclusively at No. 15 Dey Street, and that the Boston headquarters will be little more than a branch. The company is now incorporated under the laws of New York, and President Vail and the other executives spend fully half their time in that city. The holdings of the New England investors are, however, larger than they have ever been; in fact, it is said that over 70 per cent of the stock of the company is owned in that section. One of the principal reasons for the change of base is that the company is hampered by the strict laws of Massachusetts in regard to capital increases and other corporate matters. The earnings of the company continue to increase with every report, and in the first four months of the current year the surplus available for dividends amounted to $12,850,000, an increase of 15.1 per cent over the corresponding period last year.

Car Lighting and Heating on the New Haven Railroad.—Experiments have recently been conducted by the New York, New Haven & Hartford Railroad Company looking to the heating and lighting by electricity of all trains operated within the electric zone on the New York division. It is said that this system will probably be put into effect with the extension of the electric zone from Stamford to New Haven. When the electric trains were first put in operation it was not thought advisable to use electricity for light and heat, because the plans had not then been fully developed. It is said that it is now estimated that this service can be done inexpensively by electricity. There are about 2500 coaches operated over the New York division, which are now heated by steam and lighted by gas. The through trains are electrically lighted by small motors in the baggage car. The company also has ten multiple unit cars, built entirely of steel, which are heated and lighted by electricity at present. These are in service between New York and Stamford.

Mohawk Hydroelectric Company.—The Mohawk Hydroelectric Company has recently been incorporated at Albany with a nominal capital stock of $10,000. This company was promoted and the plant is being constructed by William Barclay Parsons, of 60 Wall Street. It is located at Ephrata, Fulton County, New York. This company proposes to construct a dam across the Garoga Creek. The project is being financed by S. G. Loving & Son, of Boston. The General Electric Company will furnish all of the apparatus for the power plant, amounting to about 4000 kw. The Fulton Gas & Electric Company will be the principal customer for the energy developed at this plant.

Cheaper Cable Rates Coming.—Theodore N. Vail, president of the American Telephone & Telegraph Company, arrived from Europe last week. He said that he had been having conferences in London with the officers of the Anglo-American Telegraph Company and the Direct United States Cable Company, Ltd., to bring about closer international wire relations. He denied that any financial connection between these concerns and his company was contemplated. He said that, while the subject matter of these conferences was not to arrange a system of cable letters at certain hours of the day at reduced rates, similar to the telegraph companies' night letters, this matter was talked of and that he believed it would eventually be brought about. He said that it was a little early yet for such a development, and that the conferences were mainly for the purpose of establishing closer relations between the cable companies and our telephone and telegraph companies.

Fairmont & Pittsburgh Railway.—The route of the Fairmont & Pittsburgh Railway, incorporated in West Virginia about a year ago, has been surveyed and much of the right-of-way secured. Construction work has been started on several sections of the line. Last week the new company took over the rights, franchises and charters of the Waynesburg & Monongahela Electric Railway, which covered a number of points from Waynesburg, Pa., along the Monongahela River, and a branch line extending northwest from Blacksville, W. Va. It is said that the tracks of the Pittsburgh Railways Company may be used within the city limits by the new interurban line.

Thornton Light & Power Company.—Col. M. E. Thornton, president of the Thornton Light & Power Company, and of the Hickory Water Power Electric Company, of Hickory, N. C., announces that he has sold $1,000,000 of bonds of the project to New York financiers, and will proceed with the construction work at once. The plan is to build a hydroelectric plant on the Cabawba River, near Hickory, where it is estimated that 9000 hp can be developed. It was also stated some months ago that a large cotton mill concern had contracted to locate its plant at Hickory, which would furnish an immediate market for the energy of the new power company.

Hartford Electric Light Company.—The Hartford Electric Light Company has contracted with Westinghouse, Church, Kerr & Company and with the General Electric Company for an addition to its Dutch Point Station. It is proposed to double the capacity of this plant, and the improvements will probably cost about $400,000. The present building is to be enlarged about 50 per cent. Two horizontal Curtis turbines rated at 5000 kw each will be installed by the General Electric Company, which will increase the capacity of the plant to about 25,000 hp. Additional boilers will be installed to provide for these turbines.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Washington, D. C.; Salem, N. J.; Oliver, Ga.; Stettler, Alta., Can.; Amory, Miss.; Troy, Ala.; Bedford City, Va.; Ocala, Fla.; St. Augustine, Fla.; La Fayette, Ga.; Sturgis, Mich.; Reading, Mass.; Oskaloosa, Ia.; Placerville, Cal.; Newport, Wash.; Redmond, Ore.; Detroit, Mich.; South Bethlehem, Pa.; Richmond, Ind.; Cincinnati, O., and Peoria, Ill.

Illinois Tunnel Company Telephones.—The Illinois Tunnel Company has established four central operating stations for the automatic telephone service in the loop district of Chicago. These stations will have a capacity of from 40,000 to 50,000 telephones. The company also plans to establish a fifth station in the stockyards district. It is said that 20,000 telephones will be installed by Sept. 1, ten months in advance of the time limit required in the franchise ordinance.

Equipment Sales by the General Electric.—The General Electric Company has recently sold to the New York & Nassau Construction Company, of Roslyn, electrical motor equipments for four cars. Two of these cars have two-motor equipments and two have four-motor equipments with air brakes. It has also sold to the New York & Queens County Railway Company 25 two-motor equipments for new cars.

Crocker-Wheeler Officers Re-elected.—The election of officers of the Crocker-Wheeler Company has just taken place. The following will serve during the ensuing year: President, Schuyler Skaats Wheeler; 1st vice-president, Gano Dunn; 2d vice-president, Arthur L. Doremus; chief engineer, Gano Dunn; secretary, Rodman Gilder, and treasurer, W. L. Brownell.

Industrial Power Plant in Mishawaka, Ind.—The Simplex Motor Car Company, of Mishawaka, Ind., is extending its factory so that its capacity will be nearly doubled. C. A. Chapman, Inc., of Chicago, is designing an electric power plant of considerable size to supply electrical energy for the operation of the entire factory.

Illinois Tunnel Company.—Announcement has been made in Chicago setting forth the physical condition of the property of the Illinois Tunnel Company. It comprises a comprehensive freight system running under the principal business streets of the city, and connecting with the majority of the large commercial and packing houses, including Armour & Company, Marshall Field & Company, Montgomery, Ward & Company, etc. The tunnel is constructed of concrete and steel, and, while not spacious enough to permit the running of an ordinary freight car, operates smaller cars capable of carrying six tons. The tunnel now has a total trackage of about 62 miles, but all of this is not in operation owing to the unsettled condition of the company's finances. The cars are hauled by small electric locomotives, and there are about 3500 cars in daily service. While the returns are not at present sufficient to pay interest upon the heavy capitalization of the company, it is believed that when the automatic telephone system now being constructed through the tunnel is in operation the company can be placed in a satisfactory financial position.

Competition in Denver.—An inquiry has been made of the Denver Election Commission, by a firm of lawyers, asking the probable cost of submitting to the voters a franchise for a new electric system in the city. The identity of those making the inquiry is withheld by the commission but it is believed in Denver that it comes from representatives of the Central Colorado Power Company. It is said that this company has been laying plans in that direction for several months and it may be that the franchise will be submitted at the September special election.

Long Beach Company Increases Capital Stock.—The Long Beach, Cal., Electrical Manufacturing Company, whose method of recharging fuses has attracted considerable attention, has decided to reorganize on a larger scale and to increase its capital from $20,000 to $250,000. According to local papers, this industry has had the support of the Long Beach Chamber of Commerce from the start, and the citizens generally are pleased to learn of its success.

Mackay Companies' New Cable.—It is said that the Mackay Companies has made plans to lay another cable between England and the United States in the coming year. The new line will be on the Ireland-Newfoundland-New York route. The Commercial Cable Company already has five lines in operation between England and America. A new cable will cost more than $3,000,000.

Financial.

The Week in Wall Street.

AFTER a week that had been unsually dull and unsatisfactory, a week in which there appeared to be no genuine buying and where any attempt to liquidate long stock resulted in a serious break, the stock market began the new week, June 27, with such a sharp decline that it almost amounted to demoralization. The rumor factories were working overtime, and crop damage and the illness of Mr. Morgan were discussed on every corner. By many these stories were held responsible for the heavy selling pressure, but as a matter of fact these reports had little effect. When Mr. Morgan appeared in Wall Street the picture of health and strength, the market made no recovery. The truth of the matter is that the market is heavy in tone and there is no buying interest outside of the buying done by big financiers for the sole purpose of holding prices. During the week there were some very definite efforts made by large houses to hold the market, but without success. The disposition to sell is vastly more insistent than the inclination to buy, and whenever professionals undertook to sustain prices they were swamped with offers of stock. While the bears were not conspicuous in raiding the market June 27 they were ready to help the decline along with an extra push whenever a rally seemed imminent. The result of this was that prices sagged all during the day and the close was at about bottom figures. Amalgamated Copper, General Electric, Union Pacific, Reading, Southern Pacific and Steel common were the weakest issues. In the majority of cases the closing figures were near the low record for the year. The money market continues to be easy and rates show no disposition to advance. Quotations June 27 were: Call, 2⅞@3 per cent; 90 days, 4¼@5 per cent. The quotations in the table are those of the close June 27.

NEW YORK

	June 20.	June 27.	Shares sold.		June 20.	June 27.	Shares sold.
All.-Ch.	9	8¼	500	Int.-Met., pfd.	52	50	16,950
All.-Ch., pfd.	30⅛*	31	200	Mackay Cos..	88*	88	1,100
Amal. Cop...	63¼	61⅝	142,660	Mackay C., pf.	74⅜*	75*	242
Am. D. T....	20½*	20½*	——	Man. Elev...	130*	130*	735
Am. Loc.....	44½	41¼	2,825	Met. St. Ry..	15*	15*	——
Am. Loc.,pfd.	107¾	108	200	N.Y.&N.J.Tel.	130¼*	130¼*	——
Am. Tel. & C.	75*	75*	——	Steel. com...	78⅞	74⅜	394,600
Am. T. & T..	137	135	6,700	Steel, pfd....	116⅛	115½	10,600
B. R. T.....	79⅛	76	46,343	W. U. T....	64½*	63½	500
Gen. Elec....	147	143	900	West'h., com.	63¼	62	8,275
Int.-Met. ..	19	18	9,350	West'h, pfd..	114	123*	200

PHILADELPHIA.

	June 20	June 27.		June 20	June 27.
Am. Rys.....	41*	41	Phila. Elec.....	14⅞	14¾
Elec. Co. of A.....	11½*	11⅝	Phila. R. T.....	20⅜	19
Elec. St. B'ty.....	54¼	53	Phila Trac.....	84½*	84½*
E. S. B'ty. pfd.....	30*	30*	Union Trac.....	47	46½

CHICAGO.

	June 20	June 27.		June 20	June 27.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	120	118⅛
Chi. Rs., Ser. 1.....	75*	75*	Met. El., com.....	24½	24*
Chi. Rs., Ser. 2.....	17	18	Met. El., pfd.....	69	69
Com. Edison.....	116*	114	Nat'l Carbon.....	117	116
Chi. Subways.....	2½*	2½	Nat'l Car., pfd.....	119*	118

BOSTON.

	June 20	June 27.		June 20.	June 27.
Am. T. & T.....	136⅞	135	Mex. Tel.....	5⅝*	6
Cum. Tel.....	142	142*	Mex. Tel. pfd.....	6¼*	6½
Edison E., Ill.....	248	250	N. E. Tel.....	132½	132*
Gen. Elec.....	147¼	145	W. T. & T.....	15¾*	15¼*
Mass. E. Ry.....	16	16	W. T. & T., pfd....	86*	87*
Mass. E. Ry., pfd...	80*	80			

*Last price quoted.
Shares sold for week of June 20 to June 25.

Financial Notes.

International Traction Company Reorganization.—In response to requests of many holders of the 50-year 4 per cent collateral trust bonds of the International Traction Company of Buffalo, Robert L. Fryer, Thomas De Witt Cuyler, Lewis Cass Ledyard, Thomas E. Mitten and Charles Steele have been selected as a committee to protect the interests of all the bondholders. J. P. Morgan & Company will act as depositary. The traction company is a New York corporation, and owns all the stock of the International Railway Company, this stock being the main security for the collateral trust bonds above referred to. The Railway company owns and operates properties in Buffalo and vicinity. The company has issued all of the bonds under the collateral trust indenture which were reserved for extensions and betterments, but there remains unissued $11,665,000 of bonds reserved exclusively for the acquisition or retirement of underlying bonds secured by liens on the property. Many of these underlying obligations mature in the near future, and cannot be provided for by the collateral trust bonds, which have a limited market and are selling far below par. This condition makes some sort of a reorganization necessary. The International Traction Company was organized in 1899 with $10,000,000 common stock and $5,000,000 4 per cent cumulative preferred stock, all of which is outstanding. The company acquired all the electric railways connecting Buffalo, Niagara Falls, Lockport, North Tonawanda and Tonawanda, together with all the street railway systems in all of these cities. It also owns the Canadian Electric Railway, which it has connected with the American system by the acquisition of the steel arch bridge at Niagara Falls and the suspension bridge between Queenstown and Lewiston. It is now proposed that the committee purchase the pledged stocks of the Railway company when sold at foreclosure. A new company will then be formed to operate some other railway line which by merger will acquire the stock and property of the present company, subject to outstanding mortgages.

American Telephone Company in Nebraska.—The American Telephone & Telegraph Company has offered to exchange its shares of stock for the Nebraska Telephone Company, which it now controls, on the basis of three shares of American for each four shares of Nebraska. Fractional shares will be bought at the rate of 105. The Nebraska Telephone Company has outstanding $4,572,300 stock, of which the American now owns 58.33 per cent.

Sale of Forty-Second Street Road.—The United States Court, in New York, has set Sept. 1 as the date for the sale of the property of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company, under foreclosure. The property will be bought by the bondholders' reorganization committee.

Commonwealth Edison Company.—The Commonwealth Edison Company has paid to the city of Chicago $325,313, as annual compensation for the year ending May 31, 1910. This is 3 per cent on $10,824,469 derived from the sale of energy, and 10 per cent on $5,792 derived from rental of conduit space.

Lighting Complication in Montgomery, Ala.—Announcement was made in Montgomery, Ala., last week that Alex Rice and his associates, who own and control practically all of the stock of the Citizens Light, Heat & Power Company, had sold their entire holdings to Richard Tillis, the deal involving $135,000. Mr. Tillis is a capitalist of Montgomery, and is interested in the Montgomery Traction Company. The stock transferred is the stock which H. L. Doherty & Company claim to have contracted to buy in May, and for the delivery of which they brought suit two weeks ago in the Alabama courts. A statement has been issued to the public signed by Mr. Tillis, stating that he has purchased the stock and that he intends to enlarge the generating plant of the Citizens company and extend its lines to all sections of the city, and that all contracts of the old company will be carried out, and service will be furnished—a high-grade service—at lowest possible rates. The officers of the company will remain as at present, and Paul R. Whiting will continue as general manager. In a published statement, Messrs. Rice, Whiting and the other officers of the company give their version of the deal with H. L. Doherty & Company. This statement says that Mr. Rice while in New York, May 13, signed a contract to sell for a stipulated sum the stock of the company which he represented, delivery to be made June 15. He says on June 15 Mr. Rice met the local representatives of the Doherty interests prepared to make the transfer, but that the latter would not carry out their part of the contract, and later in the day they refused point blank to carry out parts of the contract. He says that on June 16 a representative of Mr. Tillis held a conference with his representative and reached an agreement whereby the property was eventually transferred to Mr. Tillis and his associates, and that they are now in charge of it. The purchase price, he says, has been paid in cash. Many of the debts of the company have been paid, and the rest will be paid as soon as vouchers can be made out. According to this statement, the transfer to Mr. Tillis was made one day before H. L. Doherty & Company secured an injunction restraining the officers of the company from selling their stock. At the office of H. L. Doherty & Company, 60 Wall street, New York, a statement of the Doherty position was made, which indicates that for a long time the owners of the Citizens company had been endeavoring to negotiate with H. L. Doherty & Company for the sale of their property, and that in the final contract Mr. Doherty gave very much more liberal terms than he had agreed to offer at any previous time. After the contracts were signed Mr. Doherty agreed that no public announcement should be made until the actual transfer of the stock on June 15, and on that date his agent was in Montgomery "fully prepared in every way to carry out our contract both in letter and spirit." Mr. Rice, he says, could not be found, and the man designated as his agent flatly denied that he was authorized to execute the contract. H. L. Doherty & Company intend to insist upon the execution of the contract, and it is stated at the Doherty office that if necessary an effort will be made to throw the property into the hands of a receiver in order to settle the controversy. The statement also says that the plans of the Doherty interests were to make a material reduction in the schedule of prices, to enlarge the present hydroelectric plant, to increase the steam auxiliary plant and to inaugurate a comprehensive plan for the development of Montgomery industrial interests. We are informed by the general manager of the Citizens company that the $35,000 item which entered into the Doherty deal was stipulated to be paid to Rice, Ball and Whiting for services rendered and was put in a separate supplemental agreement.

Elevated Merger in Chicago Assured.—The merger of the four elevated roads in Chicago is now practically assured. The directors of both the South Side Elevated and the Metropolitan West Side Elevated have accepted the offers of the Henry A. Blair syndicate. The other companies involved have already accepted. It is given out in Chicago that the merger syndicate has allowed 75 for the preferred stock of the Metropolitan Elevated, which is 2½ more than the last previous offer. The offer for the common is 27.50. Other purchase prices are unchanged. The South Side Elevated Company will declare a cash dividend out of surplus as a part of the purchase price. Before the transfer of stock to the Blair Syndicate can be begun, the action of each board of directors must be approved by a two-thirds vote of the stockholders of each company. This will require several weeks. The directors consider the purchase offer is good, and advise the stockholders to accept. When the consolidation is effected many improvements, such as the through routing of trains or the transfer of passengers from one line to another, will be effected, and the service will be made more efficient and convenient for the traveling public. It is believed in Chicago that eventually all of the surface lines will be united in a $150,000,000 corporation, and that this corporation will merge with the elevated consolidation, placing all the traction interests in the city in one company.

Denver Gas & Electric Company.—The annual meeting of the stockholders of the Denver Gas & Electric Company, which has already been postponed several times, has again been postponed subject to call. It is given out that these postponements are occasioned on account of the inability of H. L. Doherty, president of the company, to be present in Denver. Of the $25,000,000 bond issue which was authorized by the Denver Gas & Electric Company at the recent reorganization, but $730,000 has up to this time been utilized. This amount was sold for the purpose of acquiring the plant of the Denver Steam Heating Company, and adjoining property on which it is intended to build an extensive power plant. At the office of H. L. Doherty & Company it is stated that there is no immediate intention of reorganizing the Denver Steam Heating Company, or of merging it with the Denver Gas & Electric Company. The concern will be operated under the old name for the time being.

Westinghouse Back Dividends.—At the meeting of the board of directors of the Westinghouse Electric & Manufacturing Company the regular quarterly dividend of 1¾ per cent on the preferred stock was declared. This is payable July 15. No action was taken on the matter of paying the back dividends outstanding, which now amount to 8¾ per cent. A director is quoted as saying that consideration of the payment of these back dividends was postponed to the fall meeting. It was believed that a better use could be made of the surplus funds of the company in the manufacturing plant. The banking interests which have controlled the policy of the company since the receivership are in favor of strengthening its working capital.

Southern Telephone Consolidation.—The merging of the Southern Bell Telephone & Telegraph Company and the Southern Telephone & Telegraph Company has been announced. The former company will take over the latter, and it is given out that $200,000 will be expended in the near future on extensions and improvements. The Southern Bell has capital stock outstanding of $20,400,000, 99.96 per cent of which belongs to the American Telephone & Telegraph Company. It operates under the Bell patents in Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia and a portion of West Virginia. The Southern Telephone company is an independent concern, with $170,000 capital, operating in Hot Springs, Ark., and vicinity.

Consolidated Gas, Electric Light & Power Company, of Baltimore.—E. H. Rollins & Sons, of Boston, are offering $4,000,000 4 per cent three-year notes of the Consolidated Gas, Electric Light & Power Company, of Baltimore, at 97½. Associated with Rollins & Sons are William Salomon & Company and Estabrook & Company, of New York. These notes are issued to retire $3,584,500 Consolidated Gas Company 6 per cent bonds maturing July 1, and to reimburse the company for money expended for additions and betterments. The issue has been approved by the Public Service Corporation of Maryland.

Pacific Gas & Electric Company.—A statement has been issued for the New York stock exchange by the Pacific Gas & Electric Company, giving the financial standing of that company at the end of its fiscal year, March 31, 1910. The total assets of the company, including more than $1,500,000 in cash and bills receivable, amounted to $113,757,659. The company has outstanding $30,000,000 in stock, and bonds amounting to $59,177,542. The gross revenue of the company for the year was $13,332,501, and the net revenue $5,800,925.

Youngstown & Ohio River Railroad.—C. E. Dennison & Company, Boston and Cleveland, have purchased $1,000,000 of an authorized issue of $2,500,000 first mortgage 5 per cent bonds of the Youngstown & Ohio River Railroad Company. These bonds are subject to call after five years at 105 and interest. The proceeds are to be used for extension.

Chicago Railways Consolidation.—Judge Grosscup has approved of the plan of the consolidation of the Chicago Railways with the Consolidated Traction Company properties. He has suggested an umpire to settle the dispute with regard to the Cicero & Proviso line. At the same time, he warns the managers of this line that they will get no consideration in court if the city tears up the tracks, as it threatens, on account of the refusal of the company to rehabilitate the property. No opposition has appeared from the representatives of the Yerkes Estate or from the stockholders of the Chicago Railways Company. John M. Roach, one of the receivers for the Railways company, has advised the mayor that, in his judgment, an agreement will be reached very soon and he requests that the City Council do not adjourn for the summer until an ordinance for the rehabilitation of the Consolidated system can be considered. Some of the Consolidated lines are in urgent need of repair. The local transportation committee of the council has the subject under consideration, and a special meeting of the City Council may be held during the summer to receive a report from the committee.

Keystone Telephone Company.—Estimating the return for the month of June, it is figured that the gross earnings of the Keystone Telephone Company for the fiscal year will be about $1,125,000 and net earnings about $566,000. This will be a gain as compared with the previous fiscal year of about $520,000 in gross and $24,000 in net. By reducing the amount set aside for the renewal reserve fund, which the management considers has been unnecessarily large, the company in the first six months of the current fiscal year was able to report a surplus over fixed charges considerably greater than in the corresponding period of the previous year. Up to the present time, however, there has been no action taken by the directors in favor of a dividend on the preferred stock, and it does not seem likely that any will be taken. There is over 42 per cent accumulated dividends now unpaid.

American District Telegraph Company.—It is said that a movement is on foot among the small stockholders of the American District Telegraph Company, of New Jersey, to compel the management to distribute the $2,000,000 surplus now in the treasury to the stockholders as an increased dividend. The rate now paid is 4 per cent. It is stated that if the directors refuse to divide this surplus, the stockholders will carry the matter into the courts. The American District Telegraph Company has an authorized capital stock of $10,000,000, of which $9,965,350 is outstanding. The stock is widely scattered, although the Western Union Telegraph Company, through the directors, has a controlling voice in the management. This company, however, owns only about $785,000 of the stock, but, it is said, has been recently buying all of the shares available.

Union Gas & Electric Company, of Cincinnati.—The directors of the Union Gas & Electric Company have authorized a dividend of 6 per cent on the $5,000,000 cumulative preferred stock, payable June 28. During the late panic the company was forced to pass the dividends on this stock, but the deferred payments were provided for last July by the issue of interest-bearing notes running five years. These amounted to $375,000. At the meeting of the directors it was reported that the earnings of the company are increasing rapidly and that these notes will be taken care of when due. The company has an accumulation applicable to common stock, but will carry it as a surplus for the present.

Westinghouse Machine Company.—A letter has been issued to the stockholders of the Westinghouse Machine Company which says that the fiscal year of the company, which ended March 31, was one of the most prosperous in its history. The letter says that the orders received aggregated $5,123,612, an increase of $2,322,536, or 83 per cent as compared with the previous year. The billing in shop product amounted to $4,065,618, an increase of 48 per cent. The company at present is working overtime, and is employing more men than ever before in its history.

Flint (Mich.) Electric Company.—The State Railroad Commission of Michigan has granted permission to the Flint Electric Company to issue $500,000 of bonds to retire old indebtedness. This company is one of those which was included in the proposed merger known as the Commonwealth Power, Railway & Light Company, which failed to become operative as planned on account of the opposition of the Railroad Commission. The property is controlled by Hodenpyl, Walbridge & Company, of New York, and E. W. Clark & Company, of Philadelphia.

DIVIDENDS.

American Power & Light Company, preferred, quarterly, 1½ per cent, payable July 1.

Anaconda Copper Mining Company, quarterly, 2 per cent, payable July 20.

Bell Telephone Company of Missouri, quarterly, 2 per cent, payable July 1.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable July 8.

Chicago City & Connecting Railway, preferred, 2¼ per cent; common, 1 per cent, payable July 1.

Chicago City Railway Company, quarterly, 2½ per cent, payable June 30.

Consolidated Car Heating Company, 4 per cent; 2 per cent payable Aug. 1, and 2 per cent payable Feb. 1, 1911.

Edison Electric Illuminating Company of Boston, quarterly, 3 per cent, payable Aug. 1.

Gamewell Fire Alarm Company, quarterly, 1¼ per cent, payable July 1.

Gary & Interurban Railway Company, initial, 1 per cent, payable July 10.

Kansas Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable July 1.

Manchester (N. H.) Traction, Light & Power Company, quarterly, 2 per cent, payable July 15.

Mexican Telegraph Company, quarterly, 2½ per cent, payable July 15.

Northwestern Elevated Railroad Company, preferred, quarterly, 1 per cent, payable July 18.

Pope Manufacturing Company, preferred, 2½ per cent; common, 1½ per cent, payable July 30.

Pacific Coast Power Company, 2½ per cent, payable July 16.

Tri-City Railway & Light Company, quarterly, preferred, 1½ per cent, payable July 1.

United States Smelting & Refining Company, quarterly, preferred, 1¾ per cent; common, 1 per cent, both payable July 15.

Westinghouse Electric & Manufacturing Company, quarterly, preferred, 1¾ per cent, payable July 15.

REPORTS OF EARNINGS.

	Gross earnings	Expenses.	Net earnings.	Charges.	Surplus
American Light & Traction Company:					
May, 1910	273,044	8,988	246,046	.....	.....
May, 1909	222,327	8,930	213,397	.....	.....
Houghton County (Mich.) Electric Company:					
April, 1910	21,135	11,511	9,624	4,333	5,291
April, 1909	19,399	10,728	8,671	4,132	4,539
International Steam Pump Company:					
Year Ended March 31, 1910	2,003,153	440,732	1,562,421	859,938	702,482
Year Ended March 31, 1909	1,618,506	394,962	1,223,544	859,800	363,744
Jacksonville (Fla.) Electric Company:					
April, 1910	47,212	24,442	22,770	9,290	13,480
April, 1909	40,306	23,931	16,375	9,345	7,030
Kings County Electric Light & Power Company:					
May, 1910	340,101	169,380	170,721	100,773	69,948
May, 1909	297,677	146,528	151,148	88,567	62,581
Mexican Telegraph Company:					
Quarter ended June 30, 1910 (est.)	207,000	42,500	164,500	.....	.....
Quarter ended June 30, 1909	165,000	41,000	124,000	.....	.....
Montreal Street Railway Company:					
May, 1910	370,234	199,616	170,617	54,435	116,181
May, 1909	329,339	181,147	148,148	45,983	102,330
Niagara Lockport & Ontario Power Company:					
May, 1910	40,429	16,309	24,120	.....	.....
May, 1909	30,238	16,117	14,120	.....	.....

General News

Construction News.

BIRMINGHAM, ALA.—The new plant of the Birmingham Rail & Locomotive Works, now being constructed, will be equipped for electrical operation. Haskins Williams is president of the company.

BIRMINGHAM, ALA.—Preparations are being made by Caldwell & Watson for the construction of a new foundry, which will be equipped for electrical operation throughout. Electric cranes will also be placed. The cost of the plant is estimated at about $25,000.

GADSDEN, ALA.—The City Council has granted R. H. Cobb, of Gadsden, promoter of the Coosa River Power Company, a franchise to furnish electricity in Gadsden.

MONTGOMERY, ALA.—Richard Tillis is reported to have purchased 95 per cent of the capital stock of the Citizens Light, Heat & Power Company. It is understood that the consideration was about $135,000. It is proposed to make extensive additions and improvements to the plant, work on which will begin in the near future. Alexander Rice will remain as president and P. R. Whiting will be retained as general manager of the company.

OPELIKA, ALA.—At an election to be held July 15 the proposition to issue $85,000 in bonds, the proceeds to be used for construction of an electric light plant and water works, will be submitted to a vote. The citizens recently voted to issue the bonds, but the election has been declared void.

TALLADEGA, ALA.—The Alabama Power & Development Company has commenced work on the remodeling of the building in which its substation equipment will be installed. Work is progressing rapidly on the erection of the transmission lines from Anniston and Jackson Shoals. It is reported that the company will make a survey for proposed electric railway from Talladega to Gadsden, via Anniston.

TROY, ALA.—The Standard Chemical & Oil Company is contemplating extensive improvements to its plant, including the installation of electric generating machinery to provide electricity for operating all machinery, except ice plant and oil and chemical departments, which will be operated by steam.

DOUGLAS, ARIZ.—Arrangements are being made by the Copper Queen Company, which operates a large smelter at Douglas, to construct a transmission line to the mines and mills of the El Tigre Mining Company in the El Tigre district, State of Mexico, to furnish electricity for operating the same. The line will be 50 miles in length. The El Tigre Mining Company has been making investigations with a view of erecting its own plant, but decided to purchase power from the Copper Queen Company.

TOMBSTONE, ARIZ.—H. D. Madison and M. Brown have leased the plants of the Tombstone Improvement Company and the Tombstone Electric Light & Power Company, which gives the lessees control of the gas, water and electric light utilities in Tombstone, Ariz.

HOT SPRINGS, ARK.—The Southern Bell Telephone Company and the Southern States Telephone Company have consolidated, and announcement has been made that the extensions and improvements will be made, involving an expenditure of about $200,000.

IMBODEN, ARK.—The plant and holdings of the Imboden Power & Development Company is reported to have been purchased by Dr. E. N. F. Sullivan, representing the People's Bank, for $1,000. It is said that the new owners will make improvements to the plant.

BAKERSVILLE, CAL.—Bids will be received by the Board of Supervisors until July 12 for the sale of a franchise to erect lines for the transmission of electricity for lamps, heat and motors, which was applied for by the Mount Whitney Power & Electric Company. I. L. Miller is clerk.

BARSTOW, CAL.—Preparations are being made by the Barstow Utility Company for the construction of a steam laundry. It is understood that an electric light plant will be erected in connection with same. W. W. Brison, Jr., is general manager.

BERKELEY, CAL.—Surveys are being made by the Oakland Traction Company for the extension of the Euclid Avenue car line from University and Shattuck Avenues to the end of Euclid Avenue in the Wheeler tract, for which a franchise has been applied for. The company, it is said, is considering the installation of new machinery.

BERKELEY, CAL.—The City Council has granted the Great Western Power Company a franchise to construct and operate an electric system in Berkeley, bids for which will be received until July 19. Under the terms of the franchise the City Council reserves the right to specify rates and to name the districts in which the wires shall be placed underground. The franchise is for a term of 35 years, the city to have the privilege of taking over the entire holdings of the corporation at the expiration of the franchise on payment of an equable sum. Work will begin on construction of the system in the near future.

BODIE, CAL.—Bids will be received by the Board of Supervisors of Mono County until July 6 for a franchise to erect and operate transmission lines over certain roads and highways in Mono County, for which application has been made by the Standard Consolidated Mining Company. George Delury is County Clerk.

BURBANK, CAL.—E. D. Goode, president and general manager of the Glendale & Eagle Rock Railway Company, has submitted a proposition to the citizens of Burbank, offering to build an extension to this town, providing the citizens of Burbank raise $40,000 toward the construction of the railway. The proposed railway will be about four miles in length. The Glendale & Eagle Rock Railway, which connects Glendale and Eagle Rock is now building an extension to Verdugo Canon. A committee has been appointed to secure subscriptions.

BUTTE VALLEY, CAL.—Surveys are being made by the Great Western Power Company for canals, pipe lines, and water tunnels on the North Fork of the Feather River, near the mouth of Butte Creek, 10 miles below Big Meadows, where it is understood that the electric generating plant of the Big Meadows project will be located. Investigations are also being made on the North Fork, a short distance below Meadow View, or Nevis, with a view of locating a site for its large storage reservoir dam.

CHICO, CAL.—The Northern Electric Railway Company is reported to be considering plans for the extension of its system from a point near Ben Ali, on the American River, into Fair Oaks.

CORNING, CAL.—Surveys are being made by Richard Gernon, engineer, of Red Bluff, Cal., in the mountains west of Corning, it is said, to ascertain the possibilities of storing and conserving water in the Thomas Creek Canyon, back of Paskenta, to be used to generate electricity.

FRESNO, CAL.—Plans are being considered for the building of an electric railway from Fresno to Monterey. It is proposed to incorporate a company capitalized at $4,000,000 and commence work on construction of the road within 60 days. It is hoped to have the railway completed as far as Coalinga in nine months and to connect Fresno with tide water within two years. Judge Kerr, of Coalinga, Cal.; A. G. Metz, of Monterey, Cal.; George Chalmers, of San Francisco, Cal.; Dr. W. T. Burks, of Fresno, Cal., and others are interested in the project.

LOS ANGELES, CAL.—Plans are being considered by the Los Angeles-Pacific Company, of Los Angeles, Cal., for extending its railway from Hollywood over Cahuenga Pass to Lankershim. A bonus is being raised by the citizens of Lankershim to secure the proposed extension.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors until July 5 for furnishing equipment and electricity for lighting certain streets in the Downey lighting district, in accordance with specifications on file with the board. C. G. Keyes is county clerk.

LOS ANGELES, CAL.—The Board of Public Works has awarded a contract to the Llewellyn Iron Works for 188 ornamental electroliers, at a cost of $15,463. The poles are to be erected and paid for by the residents and property owners on Pico Street, from Maine Avenue to Vermont Avenue.

LOS ANGELES, CAL.—The Board of Public Works has applied to the City Council for an appropriation of $25,000 out of the revenues of the city for the fiscal year, commencing July 1, to carry forward preliminary engineering work for the aqueducts' power plants. Investigations are being made with reference to the preparations of plans, special engineering study of the ground, selection of power plant sites, transmission lines and installation of machinery.

McFARLAND, CAL.—Plans are being made by the Mount Whitney Power & Electric Company to supply electricity in McFarland and surrounding country with electricity for lamps. B. M. Maddox, of Visalia, Cal., is vice-president of the company.

PLACERVILLE, CAL.—Preparations are being made to install an electric plant at the Ralston divide mines, to furnish electricity for lamps and motors at the mines. The company is also installing a large compressor for operating drills in the tunnel. W. H. Duffy is general manager.

PRINCETON, CAL.—Preparations are being made by the Northern California Power Company to extend its transmission lines from Hamilton City to Jacinto, where electricity is to be used to operate the irrigating pumps.

SACRAMENTO, CAL.—Contracts have been placed by the Great Western Power Company for the complete equipment of its substation to be located at Eight and R Streets, Sacramento. E. P. Hilbron is local manager.

SAN ANDREAS, CAL.—It is reported that the Sierra Nevada Water Company will be reorganized under a new name and will resume work on the development of the water power of the Mokelumne River between Railroad Flat and West Point, where it expects to erect one of the largest hydroelectric power plants in the State. Frank Z. Towle was general manager of the company.

SAN FRANCISCO, CAL.—The Board of Supervisors has granted a 25-year franchise to A. J. Pon to construct a street railway on Gough

Street to connect Fillmore-McAllister Street and the Market Street Railways in San Francisco. The United Railroads of San Francisco will construct and operate the proposed street car line.

SAN FRANCISCO, COL.—The stockholders of the Natomas Consolidated Company on June 9 voted to increase the bonded indebtedness of the company from $15,000,000 to $25,000,000, the proceeds to be used to take over the capital stock of electric power companies and to pay outstanding bonds. The company is capitalized at $25,000,000 and the directors are: E. J. de Sabla, E. R. Lilienthal, Joseph Sloss, M. E. Griffin, Albert Hanford, Charles H. Hammon and Curtis H. Lindley.

SAN FRANCISCO, CAL.—City Attorney Long has advised the Supervisors in response to an inquiry, that while the city has the power to establish an electric plant in Golden Gate Park for the purpose of supplying electricity for lamps and motors in the park, there is no provision in the charter under which the plant could furnish electricity for purposes outside of the park. The city attorney also states that the plant shall be maintained strictly for park purposes and that it must be managed by the Park Board and not by the Board of Public Works or any other city body.

SAN JOSE, CAL.—Plans have been completed and the right of way secured by the Peninsular Railway Company for the proposed extension of its railway from Mayfield, through the Stanford estate to Redwood City, San Carlos, Belmont and San Mateo. Work on construction of the road, it is understood, will commence in the near future. F. E. Chapin is general manager.

SAN RAFAEL, CAL.—Business men of Novato, San Rafael, San Anselmo, Kentfield, Larkspur and Corte Madera are interested in a project to raise $125,000 to commence work on the construction of an electric railway from Corte Madeira through Ross Valley towns to Novato. It is estimated that $65,000 must be raised in order to float bonds for the proposed road. William Kent, of Kentfield, Cal., is one of the promoters.

VALLEJO, CAL.—The Board of City Trustees is reported to be considering the question of calling an election to vote on the proposition to issue $320,000 in bonds for public improvements, including the installation of a lighting plant.

VALLEJO, CAL.—The directors of the Vallejo & Northern Electric Railway Company have decided to call a special meeting of the stockholders on July 28 to vote on the proposition to increase the capital stock of the company from $2,500,000 to $10,000,000.

DENVER, COL.—The Central Colorado Power Company has been requested by a large number of mine owners in Parke County, especially in the Alma and Fair Play mining districts, to extend its 100,000-volt transmission line to those districts.

DENVER, COL.—It is stated that plans have been prepared for the construction of the Denver, Greeley & Western Electric Railway, which will be completed within the next 18 months. The proposed railway will extend between Denver and Greeley. Electricity for operating the road, it is said, will be furnished either by the Central Colorado Power Company or the Northern Colorado Power Company.

PRIMOS, COL.—The Primos tungsten mill has been placed in commission. The plant has a daily producing capacity of 50 tons, and is equipped for electric-motor drive throughout.

HARTFORD, CONN.—The Hartford Electric Light Company has awarded contract for the construction of an addition to its Dutch Point power plant to Westinghouse, Church, Kerr & Company, which will double the output of the plant. The cost of the work is estimated at $400,000, and will include the erection of a steel, concrete and brick building, to cost about $75,000, and the installation of boiler and engine equipment. Two horizontal Curtiss steam turbines will be installed by the General Electric Company. The stockholders on June 15 voted to issue $600,000 additional capital stock, making the total issue of the company $3,000,000. Austin C. Dunham is president of the company.

WASHINGTON, D. C.—Contracts have recently been placed by the United States Navy Department with the Allis-Chalmers Company, of Milwaukee, Wis., for motors and switchboards for the Indian Head Proving Grounds. The order includes 25 induction motors varying in size from 100 hp to 5 hp and eight motor panels.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 16 for two 100-kw, synchronous motor generator sets, one 2½-kw booster set and switchboard controlling equipment, for the U. S. Navy yard, Charleston, S. C. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at $11,500. R. C. Holliday is chief of the bureau.

FORT BARRANCAS, FLA.—The contract for the installation of an electric light system at Fort Barrancas, Fla., has been awarded to the McCay Engineering Company, of Baltimore, Md., for $18,043.

OCALA, FLA.—The city is reported to be contemplating the installation of two boilers of 175 hp in the municipal electric light plant, at a cost of about $3,000. It is proposed later to install two generators in the plant, which will cost about $12,000.

ST. AUGUSTINE, FLA.—The St. Johns Light & Power Company is reported to be contemplating extensive improvements and extensions to its plant, which will involve an expenditure of about $25,000, and will include the installation of a 1200-hp Corliss engine, a 650-kw generator, two exciter sets, one motor-driven and one engine-driven, contracts for which have already been placed.

LA FAYETTE, GA.—The City Council is reported to have engaged J. B. McCrary & Company, of Atlanta, Ga., to prepare plans for a municipal electric light plant and water works system.

OLIVER, GA.—We are informed that construction of an electric power plant in Oliver, Ga., at a cost of about $300,000, is under consideration. D. G. Zeigler, of Savannah, Ga. is engineer in charge.

SHELLMAN, GA.—Bids will be received by the Water and Light Department of the City of Shellman until July 3 for one 500-gal. pump, one 200-cu. ft. air compressor, one 66 x 16 return tubular boiler and the construction of a 100,000-gal. reinforced concrete reservoir. C. P. Payne is superintendent.

WAYCROSS, GA.—The State Railroad Commission has authorized the Ware County Light & Power Company to issue $1,000,000 in capital stock and $300,000 in bonds. The proceeds of the bonds to be used to pay for the plant purchased of the Waycross Electric Light & Power Company and for improvements.

IDAHO FALLS, IDAHO.—George H. Lawrence has announced that he has succeeded in financing a project to construct an electric railway to connect Idaho Falls and Hizer Hot Springs. Work on construction of the railway, it is understood, will commence about July 1.

ST. MARIES, IDAHO.—It is reported that preparations are being made by the St. Maries Light & Power Company for the construction of a power plant on the St. Maries River, to cost about $35,000.

MARION, ILL.—Preparations are being made by the Ohio & Mississippi Valley Telephone Company to entirely rebuild the local telephone system at a cost of about $30,000. A. A. Wicks is manager.

PEORIA, ILL.—The Peoria Railway Terminal Company is constructing a new fireproof power house, 72 x 200 ft., with machine shop and blacksmith shop attached. Plans are now being considered for equipment, to cost about $60,000. E. A. Burrill is vice-president and general manager.

BEDFORD, IND.—The Bedford Power Company has awarded the contract for the construction of its plant at Bedford to the Moore-Mansfield Construction Company, of Indianapolis, Ind. The cost of the plant is estimated at $500,000.

EVANSVILLE, IND.—The Evansville Railways Company has awarded a contract for the construction of its railway from Rockport to Grandview, Ind., 6½ miles in length, to the Tennis Construction Company. Contracts for the construction of two substations and 21 miles of high-tension transmission lines have been let to the General Electric Company. W. A. Carson is general manager.

HAMMOND, IND.—The Citizens' Light & Power Company, of Hammond, Ind., has dissolved, its property having been taken over by the merger.

INDIANAPOLIS, IND.—The contract for construction of the new power house of the Indianapolis Traction & Terminal Company has been awarded to the Bedford Stone & Construction Company, to cost about $280,000. The building will be located on West Tenth Street, west of White River. The contract includes the entire plant, with the exception of the smoke stack and mechanical equipment.

REDKEY, IND.—The Town Board of Trustees is reported to have granted a franchise to Attorney Hammond, of Muncie, Ind., representing an eastern syndicate, to install and maintain an electric light system in Redkey.

RICHMOND, IND.—Preparations are being made by the Terre Haute, Indianapolis & Eastern Traction Company to increase the output of its power plant in Richmond, which will include the installation of a battery of four or five boilers. When improvements at the Richmond plant are completed, it is said that the Greenfield plant will be abandoned.

SHOALS, IND.—A franchise has been granted to James F. Lynch, of Danville, Ind., who proposes to construct an electric plant in Shoals with a view of supplying Shoals and neighboring towns with electricity for lamps and motors.

VALPARAISO, IND.—The Valparaiso & Northern Railway Company has commenced work on the construction of its proposed electric interurban railway in Valparaiso, which will be extended to Chestertown and eventually to Gary, Laporte and Michigan City, Ind.

CRESTON, IA.—It is reported that business men have subscribed $40,000 toward the construction of an interurban railway through Macksburg and Winterset to Des Moines.

OSKALOOSA, IA.—The Oskaloosa Traction & Light Company expects to place contracts within six weeks for an extension to its boiler house, and will also purchase one 250-hp boiler and one 1000-gal. hot water pump. H. W. Sarner is purchasing agent.

CONWAY SPRINGS, KAN.—J. M. Frantz, of Conway Springs, Kan., is reported to be interested in a project to construct an interurban railway, to connect Hutchinson, Haven, Mt. Hope, Andale, Goddard, Viola, Conway Springs and Arkansas City; two branches will be built, one between Wichita and Goddard, and the other from Conway Springs to Anthony.

EMPORIA, KAN.—Plans are under way for the installation of an electric railway system in Emporia. It is proposed to organize a company and purchase the local electric light plant and establish a street-car service. Judge J. H. Dyer, of Dayton, Ohio, is interested in the project.

EMINENCE, KY.—The capital stock of the Henry County Telephone Company has been increased from $100,000 to $158,000.

SUGARTOWN, LA.—The Calcasieu Telephone Company, recently incorporated with a capital stock of $10,000, proposes to build telephone lines connecting small towns in the north part of the parish. Lines will be erected from Sugartown to Bannister, Dry Creek, Kipling and other points.

WHITE CASTLE, LA.—The City Council is reported to have granted the Dunlap Electric Light Company, of Plaquemine, La., a franchise to furnish electricity for lamps in White Castle. The company will also supply electrical service in Turnerville, a suburb of Plaquemine, and in Addis, La.

FORT McKINLEY, MAINE.—The Lord Electric Company has been awarded the contract for construction and remodeling the electric lighting system at Fort McKinley, Maine, for $4,698.

BALTIMORE, MD.—Richard B. Fentress, of Norfolk, Va., is reported to be interested in a project to organize a company to construct a power plant to furnish electricity for light, heat and motors. Carrington & Carrington, Maryland Telephone Building, Baltimore, Md., are his local representatives.

BALTIMORE, MD.—The Falconer Company, of Baltimore, Md., manufacturers of banking stationery, etc., is reported to have awarded a contract for construction of its plant at Gay and Water Streets, Baltimore, to J. O. Hederman, of Baltimore, Md. The building will be 70 x 125 ft., five stories high. An electric power plant will be installed and all machinery equipped for electric motor drive. Parker, Thomas & Rice, 1109 Union Trust Building, Baltimore, Md., have charge of the work.

BELAIR, MD.—The Public Service Commission has approved the application of the Susquehanna Transmission Company to erect transmission lines on the public highways in Hartford County. The company, which was incorporated to transmit electricity from McCall's Ferry to Baltimore, has been granted a franchise by the County Commissioners of Hartford County.

FITCHBURG, MASS.—Contracts have been closed between the Crocker-Burbank Company and the Connecticut River Transmission Company, whereby the last named company will furnish electricity to operate all the paper mills of the Crocker-Burbank Company in Fitchburg. Electricity generated at the plant on the Connecticut River, at Vernon, Vt., is used in two of the paper mills of the Crocker-Burbank Company. Work will commence at once on the construction of substations to furnish electricity to the mills that are not close to the line which runs from Vernon to the Beech Street substation in Cleghorn. Seven mills now in operation and one to be erected within a year are included in the contract. The Connecticut Company is increasing the output of its power plant at Vernon, Vt., including the installation of six new generators.

FORT ANDREWS, MASS.—The contract for installing an electric light system at Fort Andrews, Mass., has been awarded to the Lord Electric Company, of New York, N. Y., for $10,323.

MILLBURY, MASS.—The committee appointed by the town has agreed to sign a contract with the Millbury Electric Light Company for street lighting for a term of 10 years, under which the town is to be lighted by tungsten lamps instead of arc and incandescent lamps as at present. The company agrees to furnish 60-cp tungsten lamps at $16.50 each per year; 40-cp lamps at $14.50 each, and 32-cp at $13.50 per lamp per year. The cost of street lighting will be about $3,000 per year; the present service cost the town about $3,300.

PITTSFIELD, MASS.—The Pittsfield Electric Company has applied to the State Board of Gas and Electric Light Commission for authority to increase its capital stock from $225,000 to $450,000.

READING, MASS.—The question of extending the municipal electric lighting system to North Reading is under consideration. The municipal electric light commissioners have asked for an appropriation of $12,000 to make the extension. The village of North Reading agrees to enter into a contract for 100 street lamps and for electricity for lighting the fire station and Flint Memorial Hall.

DETROIT, MICH.—Plans have been prepared by the Edwin Armstrong Company, of Detroit, Mich., for the construction of a new plant, which calls for the erection of several buildings, including a separate boiler house and power plant. The entire plant will be equipped for electric motor drive. It is said that the company has not yet decided whether to generate electricity on the premises or purchase energy from the Detroit Edison Company.

LANSING, MICH.—Work will soon commence on the construction of the Lansing-Grand Ledge Electric Railway. The third-rail system will be used. W. H. Zimmerman & Company are engineers in charge of construction.

OWOSSO, MICH.—The property of the Owosso & Corunna Electric Company was sold at public sale June 15 to William Eaton, of New York, N. Y., who is said to be largely interested in the Commonwealth Power Company, of Jackson, Mich. The property includes four miles of track and power house. The company furnishes electricity for the Lansing & Northeastern electric railway, which is being built into Owosso.

ST. JOHNS, MICH.—The Board of Public Works has placed contracts with the Allis-Chalmers Company, of Milwaukee, Wis., for new equipment for the municipal electric light plant, including one 187½-kva and one 350-kva. 2300-volt, three-phase, 60-cycle, belted alternators, a 5-kw and a 9-kw exciter and switchboard. The municipal plant is to be changed from single to the three-phase system.

STURGIS, MICH.—Proposals will be received by the Board of Public Works until July 7 for the construction of a brick and concrete water power station, excavation for tail race and construction of dam. Plans and specifications can be seen at the office of J. S. Flanders, manager, Sturgis, Mich. Gardner S. Williams, of Ann Arbor, Mich., is consulting engineer.

EAST GRAND FORKS, MINN.—Bids will be received by James Gorman, city clerk, until July 5 for a street railway franchise.

VIRGINIA, MINN.—The contract for installing the ornamental illuminating system for Chestnut Street has been awarded to the Lawrence Goodspeed Electric Company, for $5,498.

AMORY, MISS.—It is reported that the city is contemplating extensive improvements to the electric light plant recently purchased from the Amory Light & Power Company and the installation of a waterworks system, which will involve an expenditure of about $65,000.

OSYKA, MISS.—Plans have been prepared by Xavier A. Kramer, of Magnolia, Miss., for the construction of an electric light plant and water works system in Osyka. The proposition to issue bonds to the amount of $14,000 will be submitted to a vote.

SEMINARY, MISS.—The Cumberland Telephone Company has purchased the plant and holdings of the People's Telephone Company in Seminary, Miss. The Board of Mayor and Aldermen has granted the Cumberland company a 50-year franchise in this city.

CARTHAGE, MO.—The Spring River Power Company is reported to be making arrangements to construct a substation to supply electricity to quarries along the north side of Spring River. Electricity will be transmitted at 33,000 volts and will be transformed to 2300 volts.

BILLINGS, MONT.—The City Council has granted the Eastern Montana Electric Railway Company a 50-year franchise to construct and operate an electric railway on certain streets in this city. The proposed railway will connect Laurel, Bear Creek, Billings, Red Lodge, Rockvale, Belfry and Fromberg. F. A. Kesselhuth is chief engineer.

FORT MISSOULA, MONT.—Contracts have been awarded for the construction of an electric light system at Fort Missoula, Mont., as follows: For fixtures for buildings, $4,284; distributing system, $9,988 and substation, $900, to F. E. Newberry Electric Company, of St. Louis, Mo.; for switchboard and apparatus to the Westinghouse Electric & Manufacturing Company, at $2,052.

HAMILTON, MONT.—A franchise has been granted to S. R. Inch, of the Missoula Light & Water Company, of Missoula, Mont., to erect a high-tension transmission line along the public roads of the valley.

HOLDREGE, NEB.—The plant and holdings of the Phelps County Telephone Company has been sold to W. C. May, of Gothenberg, Neb. The system includes the local exchange and a number of trunk lines extending to Bertrand, Loomis, Atlanta, Holcomb and Funk. It is understood that the consideration was about $40,000. It is understood that the purchase was made in the interests of the Bell Telephone Company and that the local exchange will be a branch of the Nebraska Telephone Company.

WALTHILL, NEB.—It is reported that plans are being prepared for the construction of an electric light plant and water works system in Walthill, the cost of which is estimated at about $20,000.

ATLANTIC CITY, N. J.—It is reported that plans have been submitted to the City Council by Chairman Donnelly, of the lighting committee, for a permanent lighting system for the board walk, costing from $33,000 to $50,000, according to the number of lamp standards used.

HOBOKEN, N. J.—The City Council has awarded the Public Service Corporation of New Jersey a contract for lighting the streets of the city for a term of five years, at the rate of $75 per lamp per year. Bids were submitted on a one and three-year basis at the rate of $85 each per year.

SALEM, N. J.—The City Council has granted the Salem Electric Company a 25-year franchise. Under the terms of the franchise the company is to build a new plant, to be equipped with modern machinery, to be completed within 18 months. The company applied for a 50-year franchise.

TRENTON, N. J.—Bids will be received at the office of the City Building Commission, corner East State Street and the canal, Trenton, N. J., until July 7, for furnishing and installing lighting fixtures ready for use in the new municipal building, Trenton, N. J., in accordance with plans and specification on file at the above office. Ferdinand W. Roebling is a member of the commission.

BROOKLYN, N. Y.—Corporation Counsel Watson on June 24 rendered an opinion that the Edison Electric Illuminating Company, of Brooklyn, had no franchise in the Thirtieth Ward, and the Board of Estimate adopted a resolution instructing Borough President Steers to remove all poles and overhead wires in that territory. The company was advised that if it wished to continue to furnish electric service in the Thirtieth Ward it would have to apply for a franchise.

CORTLAND, N. Y.—Bids will be received by Andrew S. Draper, Commissioner of Education, State Capitol, Albany, N. Y., until July 12, for the improvements to the State Normal School, at Cortland N. Y., which will include electric wiring and fixtures, and improvements to water supply. Plans and specifications are on file at the State Normal

School, Cortland, N. Y., and at the office of Franklin B. Ware, state architect, Albany, N. Y., copies of which will be furnished on application to the State Architect.

FORT TERRY, N. Y.—Contracts have been awarded for the construction of an electric light plant at Fort Terry, N. Y., as follows: For wiring and fixtures, to Alfred J. Hixon, of Boston, Mass., for $8,498; to the Sperry Engineering Company, of New Haven, Conn., for construction of pole line, $12,873; transformers and wattmeters, $2,214; switchboard, $3,855; five generators and exciters, $4,895; smokestack $2,035, and construction of power house, $11,925; for engine to the Ridgway Dynamo & Engine Company, of Ridgway, Pa., at $9,100; for boilers to John W. Danforth Company, of Buffalo, N. Y., at $9,518; for steam and exhaust piping to M. L. Bayard, of Philadelphia, Pa., for $9,390.

HORNELL, N. Y.—The Hornell & Bath Interurban Railway Company has been authorized by the Public Service Commission, Second District, to issue $195,000 in bonds, the proceeds to be used in connection with the construction of its railway from Hornell to Bath.

LIMA, N. Y.—The Town Board has granted the Livonia Light & Heating Company, of Livonia, N. Y., a franchise to erect transmission lines in Lima to furnish electricity for lamps and motors. It is expected that the company will extend its service to South Lima.

MASSENA, N. Y.—Contracts have been awarded by the St. Lawrence River Power Company for the construction of an ice-sluice and forebay dam at Massena, N. Y., to the T. A. Gillespie Company, 50 Church Street, New York, N. Y. The cost of the work is estimated at $350,000.

NEW YORK, N. Y.—The Union Railway Company of the Bronx has applied to the Public Service Commission for permission to extend its surface lines from Fordham Road and Sedgwick Avenue across the University Heights Bridge at 207th Street to Amsterdam Avenue and through Emerson Street to Broadway. The extension will connect the Union and Third Avenue Railroad, of which it is a subsidiary.

NEW YORK, N. Y.—Bids will be received until July 5 by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., for repairs, alterations and additions to the electric equipment in Public Schools 28, 74, 93, 94, 166, and DeWitt Clinton High School, Borough of Manhattan. A separate bid must be submitted for each school. Blank forms, plans and specifications can be seen at the above office.

NEW YORK, N. Y.—The Board of Estimate and Board of Aldermen have approved the plans prepared by Fire Commissioner Waldo for the betterment of the Fire Department, which will involve an expenditure of about $2,200,000. The plans call for an expenditure of $207,000 for the fire alarm system for Manhattan and the Bronx, $150,000 for Brooklyn, and $10,000 for Queens. In addition, $43,000 will be spent for new fire alarm boxes. The principal change contemplated is the placing of the wires underground wherever possible. The larger portion of the appropriation will be for new fire houses and apparatus. Plans have been drawn for 25 new houses in Manhattan and the Bronx and ten in Brooklyn.

POUGHKEEPSIE, N. Y.—Application has been made to the Public Service Commission, Second District, by the Poughkeepsie Light, Heat & Power Company, of Poughkeepsie, N. Y.; the Newburgh Light, Heat & Power Company, of Newburgh, N. Y., and Hudson Counties Gas & Electric Company, of Cornwall-on-Hudson, N. Y., for permission to consolidate under the name of the Central Hudson Gas & Electric Company. The company is to be capitalized at $2,500,000. The directors will be: L. E. Perkins, A. G. Tobey, George A. Voorhees, of Poughkeepsie, N. Y.; Francis N. Bain, Hugh M. Beugler, Albert R. Beal, William R. Beal and Thaddeus R. Beal, of Newburgh, N. Y.; John L. Wilkie and Rolland A. Davidson, of New York, N. Y.

RICHMOND, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until July 5 for repairs, alterations and additions to the electric equipment in Public School 20, Vreeland Avenue, Borough of Richmond, New York. Blank forms, plans and specifications may be seen at the above office, also at branch office, Borough Hall, New Brighton, Borough of Richmond.

SARATOGA SPRINGS, N. Y.—The Town Board has granted the Hudson Valley Railway Company, of Glens Falls, a franchise to construct a railway in East Avenue, in Saratoga Springs, for the purpose of connecting the Glens Falls and the Troy divisions.

UTICA, N. Y.—The Public Service Commission has granted its consent to the receivers of the Hudson River Electric Power Company for the extension of a lease for the steam power plant and property at Utica, the apparatus contained in the substations at Little Falls, Frankfort and Oriskany and the high-tension line from Utica to Cliff Hills, to the Utica & Mohawk Valley Railway Company. The extension is granted during the life of the receivership of the petitioning company.

WILLIAMSVILLE, N. Y.—The Buffalo & Williamsville Electric Railway Company is installing a 300-kw converter and transformer in its power station in Williamsville.

BURLINGTON, N. C.—Application has been made to the Town of Burlington by the Southern Power Company for a franchise to erect its transmission lines in Burlington. Surveys have been made for the erection of the lines from Greenboro to Durham, a distance of 54 miles. Z. Taylor is representative of the Southern Power Company.

CHARLOTTE, N. C.—It is reported that negotiations have been completed by the Southern Power Company for taking over the plant and holdings of the Greenville Carolina Power Company. The Greenville plant is a hydroelectric development, with an output of about 6000 hp, located on the Saluda River, about four miles west of the town. The Southern Power Company now has five hydroelectric plants in operation with a total output of about 105,000 hp.

DURHAM, N. C.—The Southern Power Company has been granted a franchise to erect its transmission lines in Durham. It is stated that the company expects to have its lines completed to Durham within eight months, and that a 1000-hp auxiliary steam plant will be built in this town for use in emergencies. It is understood that the company asks for a 60-year franchise in Durham, and includes East and West Durham, where large cotton mills are in operation.

FORT CASWELL, N. C.—Contracts have been awarded for the installation of an electric power plant and lighting system at Fort Caswell as follows: For wiring and fixtures, to S. J. Watson, Jr., Hampton, Va., at $2,328; to Westinghouse Electric & Manufacturing Company, switchboard, $2,356; generators, $2,685; to A. D. Granger, of New York, N. Y., for distributing system, $5,263; engines and piping, $3,843; and the McCay Engineering Company, of Baltimore, Md., for transformers, at $400.

WILLIAMSTON, N. C.—The Town Commissioners will consider propositions for lighting the town by electricity until August 1, 1910. The town reserves the right to accept any bid in the meantime. B. F. Goodwin is Mayor.

MOTT, N. D.—Plans are being considered by the Dakota-Montana Telephone Company for the construction of a telephone system and exchange building in Mott. Exchanges will also be erected in New England, Regent and Bentley.

AKRON, OHIO.—Announcement has been made of a scheme which involves the harnessing of the Cuyahoga River, between this city and Cuyahoga Falls, to furnish power for several manufacturing plants, which propose to locate in this vicinity. Surveys have been made under the direction of Frank C. Downer, of Chicago, Ill., for the construction of a concrete dam 160 ft. deep, 250 ft. long at the base, and 25 ft. wide at the top.

ATHENS, OHIO.—It is reported that the Board of Trustees of Ohio University, at Athens, has rejected all bids received June 16 for erecting addition to power house, a new smoke-stack, and for new boilers, feed pumps, vacuum pumps, etc. It is said that some changes will be made in the plans and the work will be readvertised soon. I. M. Foster is secretary of Board of Trustees.

CINCINNATI, OHIO.—Preparations are being made by Ohio Electric Railway Company for the construction of three new substations on its system between Dayton and Richmond, and Dayton and Union City. Electricity for operating the new station will be furnished from the Lindenwald power plant. Equipments for the stations has been purchased from the Westinghouse Electric & Manufacturing Company. F. A. Healy is secretary.

CLEVELAND, OHIO.—Orders have recently been placed by Pickands, Mather & Company, of Cleveland, Ohio, with the Allis-Chalmers Company, of Milwaukee, Wis., for two 300-kw 250-volt, 150 r.m.p. engine type direct-current generators. These machines will furnish electricity for ore unloaders at the new dock of the New York, Pennsylvania & Ohio Railroad Company at Randall, Ohio, now under construction.

JACKSON, OHIO.—A special election will be held July 7 to vote on the proposition to issue $16,000 in bonds for the installation of a new lighting system.

LORAIN, OHIO.—The Baltimore & Ohio Railroad Company has recently purchased of the Allis-Chalmers Company, of Milwaukee, Wis., for a 300-kw, synchronous motor generator set to furnish power to operate the unloaders on its new ore dock, now under construction at Lorain, Ohio. The motor will receive alternating current at 440 volts, three-phase, 60 cycles and deliver direct current at 250 volts.

ARAPAHO, OKLA.—At an election to be held July 26 the proposition to issue bonds for the construction of an electric light plant and water works system will be submitted to the people. The cost of the work is estimated at $40,000. The O'Neil Engineering Company, of Dallas, Tex., has charge of the engineering work. M. C. Main is Mayor.

FORT SILL, OKLA.—Contracts have been awarded for the construction of an electric light plant and installation of machinery at Fort Sill, Okla., as follows: To the Kraushaar Brass Manufacturing Company, for fixtures for buildings, at $7,780; for construction of pole line, to the McCay Engineering Company, of Baltimore, Md., at $10,997; to the General Electric Company, for transformers and wattmeters, at $2,645; for engines and generators, to the Ridgway Dynamo & Engine Company, of Ridgway, Pa., at $13,400; feed-water heater, etc., to the Urbaner-Atwood Heating Company, of St. Louis, Mo., at $2,450; to Evans-Almiral & Company, of New York, N. Y., for traveling crane, $1,754; concrete floors and foundations for mechanical equipment, $2,647; boilers, $16,452; for switchboard, to the Westinghouse Electric & Manufacturing Company, at $3,863.

KINGSTON, OKLA.—Arrangements are being made by the City of Kingston for the construction of an electric light plant and ice plant and water-works system, to cost about $100,000. It is understood that contracts have been placed for machinery.

MUSKOGEE, OKLA.—It is reported that the City of Muskogee will apply to the next Legislature to pass a special act permitting the city to

issue bonds to the amount of $600,000, to provide funds to build a dam across the Grand River and equip a power plant to supply electricity in Muskogee and surrounding towns. The plant will be operated by the city, and the proposed dam will furnish the city with a gravity water supply.

TULSA, OKLA.—The Pioneer Telephone & Telegraph Company has awarded a contract for the construction of a new telephone exchange building to Van Horn & Son, of Tulsa, Okla. The cost of the building is estimated at $100,000.

ALBANY, ORE.—Surveys are being made for the construction of a transmission line from Albany to Independence, Monmouth and Dallas. The power plant in Albany will supply electricity for the three cities.

BAKER CITY, ORE.—Application has been made to the City Council by Anthony Mohr, representing the Baker Interurban Railway Company, for a 50-year franchise to construct and operate a street railway from Baker City to North Powder and Rock Creek.

PORTLAND, ORE.—The Mount Hood Railway & Power Company has secured the right of way from Portland to Bull Run for its proposed electric railway, work on which will commence in about two months. The company is erecting a power plant at Bull Run. C. H. Miller is manager of the company.

REDMOND, ORE.—The Crook County Water, Light & Power Company is contemplating the purchase of two 750-kw. three-phase generators, to be installed within six months. H. F. Jones is secretary and treasurer.

UNION, ORE.—An election will be held July 11 to vote on the proposition to issue $65,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant. The Eastern Oregon Light & Power Company now supply electricity in Union.

GRESHAM, PA.—It is reported that Howard Conover and James Hancox, of Gresham, Pa., are interested in a project to construct a railway from Titusville to Meadville, Pa.

LURGAN, PA.—A large dam is being built near Lurgan, by Joseph Hosfield, of Shippensburg, Pa., which will furnish power to generate electricity. About 500 hp will be developed.

McKEESPORT, PA.—The Jefferson-Wilson Street Railway Company has applied to the City Council for a franchise to construct and operate a street railway between McKeesport and West Elizabeth, Pa.

MOUNDSVILLE, PA.—The Panama Coal Mining Company is contemplating the installation of an engine driven electric generating set and motor driven machinery for development work at its mines.

MOUNT PENN, PA.—Bids will be received until July 5 for furnishing electricity for lighting the Borough of Mount Penn for a term of three years. Bids must specify the price for furnishing nine or more arc lamps, 40 or more 40-watt tungsten lamps or 10 or more 75-watt tungsten lamps. George C. Hartline is borough secretary.

PHILADELPHIA, PA.—It is reported that the Pennsylvania Globe Gas Company of Philadelphia, Pa., is asking for bids for the construction of a manufacturing plant to be erected at Alleghany and Glenwood Avenues. The building will be used for manufacturing lighting appliances and will be equipped for electric motor drive.

SOUTH BETHLEHEM, PA.—The Bethlehem Steel Company is reported to have completed plans for a new power plant, which will be driven by gas engines. The building will be 100 ft. x 315 ft., and will be equipped with four-cycle, double-acting units, manufactured by the company, direct-connected to alternating-current generators.

PROVIDENCE, R. I.—Announcement has been made by the Narragansett Electric Lighting Company that the rate for electricity for lamps will be reduced from 14 to 12 cents per kw-hour, to take effect from July 1. The present discounts will be maintained. The reduction was made without solicitation on part of consumers. Arthur B. Lisle is general manager.

ELLOREE, S. C.—The question of issuing bonds to the amount of $10,000 for the construction of an electric light plant and water works system at Elloree, is under consideration.

FLORENCE, S. C.—The Florence Electric & Utility Company has recently placed an order with the Allis-Chalmers Company for a 150-kw, two-phase, 60-cycle, 2300-volt, 900 r.p.m., belted alternator, together with a 5-kw exciter.

GREENVILLE, S. C.—Definite announcement has been made by the Southern Railway Company that it will soon install gas-electric motor cars for passenger service in the Greenville district.

BRIDGEWATER, S. D.—It is reported that an electric light plant will be installed in Bridgewater this summer.

PIERRE, S. D.—Bids will be received by the State Capitol Commission, Pierre, S. D., until July 22 for furnishing and installing an 80-hp. natural gas engine in the power plant of the state capitol building, to be connected with dynamos to generate electricity for lamps and motors for the building. John Hirning is secretary of the commission.

BRISTOL, TENN.—Work will commence at once on equipping the Holston Valley railway for electrical operation and is expected to be completed within a year. The cost of the work is estimated at about $100,000. It is expected that electricity from the hydroelectric plant on the Wautauga River will be available by the time the railway is completed. O. M. Warner is interested in the project.

AMARILLO, TEX.—The City Council has granted N. A. Brown, of Dallas, Tex., a franchise to construct an electric railway in Amarillo, to extend from Polk Street to San Jacinto Heights, a distance of two miles.

AUSTIN, TEX.—At an election held June 23 the citizens voted in favor of the proposition to grant C. V. Burkhead, of San Antonio, Tex., a franchise to construct a street railway system to extend to South Austin. The franchise covers all streets not occupied by the Austin Electric Company.

BRYAN, TEX.—We are advised that as yet no plans have been adopted for the proposed electric light plant. It is expected to have plans and specifications prepared within the next 60 days. J. Moloney is Mayor.

COTULLA, TEX.—We are informed that the City of Cotulla, Tex., would grant a liberal franchise to parties wishing to install an electric plant in that city. For further information address C. F. Binkley, Mayor.

EL PASO, TEX.—The capital stock of the El Paso Electric Railway Company has been increased from $1,500,000 to $2,500,000, the proceeds to be used to take up certain floating indebtedness and for extensions and improvements to its system.

FORT WORTH, TEX.—The Consumers' Light & Heating Company is reported to have increased its capital stock from $400,000 to $800,000.

FORT WORTH, TEX.—It is reported that the city is considering the question of selling the municipal electric light plant and contracting with private companies for lighting the city.

GREGORY, TEX.—Preparations are being made by C. P. Taft, of Cincinnati, Ohio, for the construction of a city on his ranch fronting on Nueces Bay, near Gregory. The proposition includes the construction of a reinforced concrete causeway across the bay to connect the proposed city with Corpus Christi and the building of an electric railway between the two places. A large number of industrial plants are located upon the ranch.

HAMLIN, TEX.—Application has been made to the City Council by H. A. Mugge, W. M. Green, F. R. Allison, Baker Hoskins and M. Greenspun, of Hamlin, for a franchise to erect a local and long-distance telephone system in Hamlin. The company agrees to allow the city to govern rates with a minimum basic rate, and after three years agrees that the city shall have an option to purchase and own the system under certain terms and conditions.

HOUSTON, TEX.—The Bay Shore Traction Company is reported to have completed preliminary arrangements for the construction of its proposed railway to connect Houston, Harrisburg and La Porte, 25 miles in length. A. Foster, of Irwin, of Houston, is president.

PALESTINE, TEX.—The City Council is reported to be considering an application for a franchise for the construction of an electric railway in Palestine. The proposition provides for an early construction of the system, two miles to be completed the first year, and two miles each succeeding year thereafter, until eight miles have been built.

SAN ANGELO, TEX.—The San Angelo Street Railway Company is contemplating extending its street railway system to the southern and western portions of the city. Samuel Crowther is president of the company.

SWEETWATER, TEX.—The City Council has granted a franchise to C. M. McLain, G. E. Romsey and W. E. Barrow, of Sweetwater, for the construction of an electric railway in this city.

TYLER, TEX.—Arrangements are being made by the Banner State Telephone Company for extensions and improvements to its telephone system, both the city and rural lines. H. E. Scobern will have charge of the work.

NEPHI, UTAH.—At a special election held recently the citizens voted in favor of the proposition to issue bonds to the amount of $15,000 for improvements to the electric light plant and water-works system.

SALT LAKE CITY, UTAH.—The Salt Lake & Ogden Railroad Company, which recently equipped its railway for electrical operation, is reported to be preparing to double-track its entire line, work on which will begin at once. The railway is 50 miles long.

MONTPELIER, VT.—The Public Service Commission has issued orders instructing the electric companies to construct their transmission lines in Montpelier and Barre. The order goes into effect at once and will include the Consolidated Lighting Company, the Vermont Power & Light Company, Cory, Deavitt & Frost Electric Company, New England Telephone & Telegraph Company, Vermont Telegraph Company, the Barre & Montpelier Traction & Power Company, Orange County Telephone Company and Moody & Almon. The order calls for a complete reconstruction of the wiring system of both cities and in particular to have a uniform voltage system for transmission of electricity; at present both high and low extension lines are in close proximity, which is claimed to be a detriment to the telephone service. The work is to be done in installments. The work to be done in Montpelier this year will be on Bailey Avenue, State Street and Main Street from the Winooski River bridge to School Street.

VERGENNES, VT.—Water power rights owned by W. Seward Webb, on Otter Creek, at Vergennes, Vt., have been purchased by W. F. Hendee, J. J. Flynn, Elias Lyman and C. W. Brownell. It is understood that the purchase was made in the interests of the Burlington Traction Company. It is estimated that the falls will develop a minimum of 3000 hp. The new owners, it is said, will erect a power plant at Vergennes and transmit electricity to Burlington.

ALTAVISTA, VA.—The Altavista Cotton Mills, recently incorporated with a capital stock of $300,000, is planning to erect a cotton mill in Altavista, work on construction of which will begin at once. The equipment of the mill will consist of 13,000 spindles and 300 looms, which will be equipped for electric drive. A. C. Hutchinson, of Charlotte, N. C., is promoter of the project. Whitted & White, of Charlotte, N. C., are engineers in charge.

BEDFORD CITY, VA.—Bids will be received until July 13 by the light committee for furnishing all material and machinery and construction of a hydroelectric plant on the James River, near Big Island; also for the erection of a transmission line to Bedford City, about 25 miles in length, and for furnishing and installing machinery for substation. Plans and specifications are on file in the office of the Mayor of Bedford City, Va., and can be seen at the office of F. R. Weller, engineer, Washington, D. C. Specifications will be mailed on application. T. C. Dennis, L. R. Gills and A. W. Robertson are members of the committee.

RICHMOND, VA.—The Common Council has adopted an ordinance providing for an appropriation of $20,000 for ornamental illumination of Broad Street, from Twelfth to Jefferson Street. The ordinance has been referred to the Board of Aldermen. It is proposed to place six large tungsten lamps on each block.

SCOTTSVILLE, VA.—The Scottsville Telephone Company, recently incorporated, is reported to be contemplating the erection of a telephone line from Scottsville to Charlottesville, Va., and through Fluvanna and Buckingham counties.

MARCUS, WASH.—The Kettle Falls Light & Power Company is reported to have applied to the County Commissioners for a franchise to construct a dam across the river, to cost $52,500; the power house and machinery will cost about $150,000.

NEWPORT, WASH.—The Washington Water Power Company is reported to be contemplating the erection of a high-tension transmission line from its power plant at Little Falls on the Spokane River, 50 miles in length, to supply electricity for lamps and motors to towns along the line. The cost of the line is estimated at $150,000.

OLYMPIA, WASH.—It is expected that the Olympia Light & Power Company will extend its system to the West Side as the $15,000 bonus required by the company has been raised.

PORT ORCHARD, WASH.—The County Commissioners of Kitsap County has granted the Bainbridge Development Company, of Port Orchard, Wash., a 50-year franchise to construct an electric railway on Bainbridge Island, in connection with ferry service to Seattle, Wash. One car line will extend from Eagle Harbor to Fletcher Bay and Manzanito and another connecting Eagle Harbor with Port Blakeley and Pleasant Beach. About 28 miles of track will be constructed, work on which will begin within six months. M. B. Jackson, Jr., is president.

CEDAR, W. VA.—It is reported that the Majestic Collieries Company, of Shamokin, Pa., is contemplating the installation of a complete coal handling plant, equipped for electrical operation.

WELLSBURG, W. VA.—It is reported that a new electric light plant will be established in Wellsburg. Many complaints have been made since the Wellsburg Electric Light, Heat & Power Company discontinued its day service about a year ago.

WORTHINGTON, W. VA.—Arrangements are being made by the Consolidated Coke Company for opening several new shafts in this vicinity. The company, it is said, will install mining and coal handling machinery, which will be equipped for electrical operation. The main office of the company is located at Fairmont, W. Va.

MILWAUKEE, WIS.—Surveys are being made by the Milwaukee Western Electric Railway Company for the right of way for its proposed extension from Fox Lake to Green Lake. It is proposed to extend the railway through to Ripon and Berlin. W. R. Elliott is general manager.

FORT MACKENZIE, WYO.—The contract for remodeling the street lighting system and building transformer station at Fort Mackenzie, Wyo., has been awarded to the F. E. Newberry Electric Company, of St. Louis, Mo., for $6,308.

STETTLER, ALTA., CAN.—The John Galt Engineering Company is reported to have been engaged by the City of Stettler to install the proposed municipal electric light plant.

POINT GREY, B. C., CAN.—Application has been made to the City Council by the British Columbia Electric Railway Company for a 40-year franchise to construct an electric street railway system in Point Grey.

VANCOUVER, B. C., CAN.—Extensive improvements are to be made to the system of the British Columbia Telephone Company, in Vancouver, which will involve an expenditure of about $5,000,000. Work has already commenced.

BERLIN, ONT., CAN.—Bids will be received by the People's Railway Company until July 15 for clearing and grading 29 miles of its proposed railway, construction of five bridge piers and one 400-ft. bridge, also for material for railway, including ties, 70-lb. T-rails, spikes, rail bonds, grooved trolley wire, trolley messenger wire, 50 miles of wire fence, etc. A. N. Warfield, of Berlin, Ont., is general manager.

BRIDGEBURG, ONT., CAN.—Investigations are being made in Bridgeburg by G. Smith, of the Canadian Niagara Power Company, with a view of submitting an estimate for furnishing electricity in this village.

GALT, ONT., CAN.—A petition has been made to the Hydro-Electric Commission by the Grand River Improvement Association to survey Grand Valley to determine the possibilities of water storage for power development and water supply.

PORT ARTHUR, ONT., CAN.—At an election held recently the ratepayers passed the by-laws appropriating $30,000 for telephone extensions and $10,000 for extensions to municipal electric light system.

WINDSOR, ONT., CAN.—At an election held June 20 the by-laws to issue $100,000 in bonds for the installation of a distributing system and station in connection with electrical service furnished by the Hydro-Electric Commission was carried. The contract with the Hydro-Electric Commission calls for 15,000 hp., of which only about 1,500 hp. will be used in Windsor and vicinity. The Electric Distributing Company has made the city a proposition for the surplus power, details of which were given in issue of June 16. The Council is considering the offer and has pledged itself not to make any contract for the disposal of the surplus power for a period of two months. The Council, it is said, will call for bids in order to secure the best rate possible.

MONTREAL, QUE., CAN.—It is reported that the Saraguay Electric & Water Company is contemplating issuing bonds to the amount of $500,000 to provide funds for the completion of its system in the suburbs of Montreal.

MONTREAL, QUE., CAN.—The Dominion Light, Heat & Power Company is reported to have submitted a proposition to the City Council offering to supply electricity to the city, should it decide to erect a distributing system for street lighting, or take over the lines and lamps of the Montreal Light, Heat & Power Company, and also offers to operate the street lighting system if the city decides not to take up the municipal street lighting project.

SASKATOON, SASK., CAN.—The ratepayers have passed 11 by-laws calling for an appropriation of $300,000 for public improvements, including water works, electric light, sewers, concrete sidewalk extensions and the purchase of a motor combination chemical and hose wagon. The ratepayers have also voted in favor of entering into a contract with the Saskatchewan Power Company to furnish electricity to operate the municipal electric plant. The company is constructing an electric plant about 12 miles below the city at a cost of about $1,000,000. It is understood that the company will develop the Saskatchewan River at this point.

CULIACAN, SINALOA, MEX.—It is reported that the Mayo River & Power Company, which obtained concessions a few months ago for the installation of a hydroelectric power plant in the States of Sonora and Chihuahua, is planning to install one or more plants in the State of Sinaloa. Surveys are being made under the direction of R. M. Jones, engineer, of Denver, Col., with a view of determining the available sites for the proposed power plants. Surveys have also been made along the rivers in Western Chihuahua and Eastern Sinaloa. Sites for two plants are said to have been located, work on which will soon begin. Under the present plans transmission lines will be erected from the plants to the various mining camps and industrial centers within a radus of 150 miles.

MEXICO CITY, MEX.—Arrangements are being made for the extension of the transmission line of the Mexico Light & Power Company to the Pachuca mining district, a distance of 36 miles. It is expected to have the line completed early in August. The receiving station at Santa Gertrudis, which is now under construction, will not be finished until about the first of the year, but this will not delay the installation of the service, as a temporary station will be established for the distribution of electricity throughout the entire district. Energy will be transmitted from the Necaxa plant at 85,000 volts.

New Industrial Companies.

THE BROOKLYN DRY CELL BATTERY COMPANY, of Brooklyn, N. Y., has been chartered with a capital stock of $5,000 to manufacture and deal in electric batteries and supplies. The incorporators are: Peter W. Timison, 1116 Bushwick Avenue, Brooklyn, N. Y.; J. S. Clauss and George P. Clauss, of Brooklyn, N. Y.

THE BROOKLYN WIRELESS & ELECTRICAL NOVELTY COMPANY, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $1000 for the purpose of manufacturing electrical novelties. The incorporators are: Samuel Schaffer, 119 Chauncey Street, Brooklyn, N. Y.; Isador Wolff and Nathaniel Schaffer, of Brooklyn, N. Y.

EDWARD P. BROCK & COMPANY, of Boston, Mass., has been incorporated with a capital stock of $20,000 to manufacture steam and power plant specialties. The directors are: J. P. Lincoln, president; Edward P. Brock, of Revere, Mass., treasurer, and J. E. Lincoln.

THE FARKAS TUNGSTEN LAMP COMPANY, of Bloomfield, N. J., has been incorporated with a capital stock of $200,000, by W. W. Wilson, of Pearl River, N. Y.; D. T. Gately, of Brooklyn, N. Y., and N. G. Wells, of Penn Yan, N. Y. The company proposes to manufacture electrical apparatus, tungsten and other forms of lamps.

THE HIGH-PRESSURE CONSTRUCTION & SUPPLY COMPANY, of Millville, N. J., has been incorporated with a capital stock of $100,000 by S. J. Franklin, W. Owen and A. Brondriff, of Millville, N. J. The company proposes to construct railroads, water, gas and electric works, tunnels, etc.

THE HUGHES ELECTRIC HEATING COMPANY, of Chicago, Ill., has been chartered by George A. Hughes, T. M. Caven and F. A. Cotharin. The company is capitalized at $50,000, and proposes to manufacture and sell electric specialties, appliances and apparatus.

THE HUNSO MACHINERY COMPANY, of Buffalo, N. Y., has been chartered with a capital stock of $10,000 by W. D. Huntington, R. D. Soars, E. A. Soars, all of Buffalo, N. Y. The company proposes to manufacture and deal in machinery, etc.

THE KLAMATH FALLS ELECTRIC SUPPLY COMPANY, of Klamath Falls, Ore., has been incorporated with a capital stock of $10,000 by C. P. Gregory, E. J. Evans, H. P. Manchester and John T. Butcher.

THE KNICKERBOCKER ENGINEERING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000. The company proposes to do a general contracting and engineering business. The incorporators are: O. P. Carpenter, A. D. Bean, of New York, N. Y., and H. A. Leonard, Brooklyn, N. Y.

THE McKINNEY CULTIVATOR COMPANY, of Atlanta, Ga., has been organized with a capital stock of $1,000,000 to manufacture patented electric traction cultivators; also cultivators operated by gasoline. The officers are: W. J. McKinney, president; W. A. McKinney, vice-president; N. C. White, secretary, and W. E. Hoach, treasurer.

THE MULTIPLE UNIT ELECTRIC COMPANY, of New York, N. Y., has been chartered by M. N. Kohn, M. M. Riglander and M. Hammond, of New York, N. Y. The company is capitalized at $100,000, and proposes to manufacture electric furnaces, cooking and heating devices.

THE M. MYRTLE BUCK MANUFACTURING COMPANY, of Machias, N. Y., has been chartered with a capital stock of $10,000 to manufacture electrical appliances, tools, etc., by M. Myrtle Buck, Ivy E. Buck, of Franklinville, N. Y.; Asher B. Emtry, of Fidelity Building, Buffalo, N. Y.

THE NATIONAL ELECTRIC SHOE SHINING MACHINE COMPANY has filed articles of incorporation with a capital stock of $750,000. The incorporators are: B. A. Tripp, A. B. Clarke and N. M. McLane, of Pittsburgh, Pa.

THE NEW YORK ROTARY ENGINEERING & ACCESSORIES MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 to manufacture motors, engines, taximeters, etc. The incorporators are: David Davis, Harry Katz, Charles M. Lackland, Jr., of 299 Broadway, New York, N. Y.

THE PALMER-HERRING MOTOR COMPANY, of Brooklyn, N. Y., has been chartered with a capital stock of $20,000 by Henry W. Palmer, 282 Henry Street, Brooklyn, N. Y.; Charles N. Herring, Frank P. Twyford, all of Brooklyn, N. Y. The company proposes to manufacture motors, engines, motor boats and vehicles.

THE ROTARY HOUSE PUMP COMPANY, of New York, N. Y., has been chartered by E. M. Sawtelle, C. M. Stevenson and A. K. Baylor, of New York, N. Y. The company is capitalized at $350,000, and proposes to manufacture engines, pumps, etc.

THE SACCO-PETTEE COMPANY, of West Newton, Mass., and Biddeford, Maine, has filed articles of incorporation of $1,600,000 by Warren Motley, of Nahant, Mass.; R. J. Richardson, of Brookline, Mass.; Lawrence A. Ford, of Beverly, Mass.; Herbert S. Allen, of Boston, Mass.; Henry Endicott, Jr., of Weston, Mass., and A. A. Ballantine, of Cambridge, Mass. The company proposes to manufacture machinery, tools, implements, etc.

THE SUCCESS NOVELTY COMPANY, of Weldon, N. C., has been chartered by George C. Green, T. M. House and James E. Kennedy. The company proposes to do a general electrical engineering business.

THE THOMPSON-SMITH COMPANY, of Oradell, N. J., has been chartered with a capital stock of $25,000 to do general contracting work by C. G. Smith, of Oradell, N. J.; E. W. Selvage, of Philadelphia, Pa.; H. N. Selvage, of New York, N. Y., and C. Smith, of East Orange, N. J.

THE UNITED SELF-WINDING ELECTRIC CLOCK COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing electric self-winding clocks, etc. The incorporators are: C. F. Bowman, A. J. Bowman, and M. M. Leavenworth, all of New York, N. Y.

THE WESTERN ENGINEERING & CONSTRUCTION COMPANY, of Kansas City, Mo., has been incorporated with a capital stock of $2000 by M. P. Connor, Charles F. Connor and W. F. Zumbrum.

Legal.

RECEIVERS APPOINTED FOR TELEPHONE COMPANIES IN TACOMA.—W. D. Tyler, of Tacoma, Wash., has been appointed receiver of the Home Telephone Company and the Northwestern Long Distance Telephone Company in the United States Court, by Judge Donworth, in a suit brought by the Portland Home Telephone Company to secure the Portland Company for advances made to the defendant companies. Los Angeles bondholders have intervened. One of the claims made is that the bondholders were given $750,000 bonds out of a total issue of $2,000,000, which were unauthorized, and these $750,000 bonds the Portland Company asks to have cancelled.

New Incorporations.

NILES, CAL.—The San Francisco & Transbay Railroad Company has applied for a charter to construct a suburban railroad from Niles to Dumbarton and crossing the bay with connections to Redwood City and Woodside, through San Francisco, a distance of 70 miles. A branch is also to extend from Redwood to Woodside and from Dumbarton to Warm Springs. The capital stock is to be placed at $1,500,000, and the incorporators are: E. Schnulenbaus, J. Comerford, A. Mulverhill and L. Block, of San Francisco, Cal.

SUNLAND, CAL.—The Sunland Rural Telephone Company has been incorporated with a capital stock of $2,200 by Philip Bogue, C. B. Johnson, J. L. Hauber and W. B. Bluefield.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed for the Southwestern Light & Power Company by W. C. Haynes, T. W. Gregory and Fred Krouger. The company is capitalized at $25,000 and proposes to furnish light, heat and power.

FORTVILLE, IND.—The Martin Telephone Company has been incorporated with a capital stock of $2,000 for the purpose of erecting and operating a telephone system in Fortville, and extending telephone lines throughout Hancock County. C. M. Anderson, Edward Rensworth, D. W. Caudell and Lucian Shub are directors.

FORT WAYNE, IND.—Articles of incorporation have been filed for the Fort Wayne & Winona Traction Company by J. A. Barry, E. G. Hoffman, E. W. Cook, G. M. Leslie, of Fort Wayne, Ind., and Ralph A. Barry, of New York, N. Y. The company is capitalized at $100,000, and proposes to construct an interurban railway from Fort Wayne to Warsaw, a distance of 40 miles. The proposed railway will ultimately connect Fort Wayne with Chicago, Ill.

BONNER SPRINGS, KAN.—The Kansas City, Kaw Valley & Western Railway Company has been chartered with a capital stock of $1,500,000 by John W. McDanield, John C. Finney, of Bonner Springs, Kan.; A. L. Cooper, W. H. Caffrey, of Kansas City, Mo., and Charles Knabb, of Hiawatha, Kan. The company proposes to construct an interurban electric railway to connect Bonner Springs and Kansas City, which will ultimately extend to Lawrence and Topeka. The new company will take over the property of the Kansas City & Bonner Springs Railway Company, which has five miles in operation, and will connect with the Kansas City Western Railway from Bethel to Kansas City. Work on construction of the railway is expected to begin within a few months.

PORTLAND, MAINE.—The Prescott Gas & Electric Company has been chartered with a capital stock of $100,000 to deal in gas and electricity. The officers of the company are: C. E. Eaton, president, and T. L. Croteau, treasurer, both of Portland, Maine.

ENID, OKLA.—The Morrow-Simmons Power Company has been incorporated with a capital stock of $100,000 by E. S. Morrow and C. M. Simmons, of Cestos, Okla., and R. E. Libbie, of Selling, Okla.

ALBANY, ORE.—The Southern Oregon Railway & Power Company has been incorporated with a capital stock of $3,000,000 to construct electric railways, power plants, etc., through Rogue River Valley. The incorporators are: J. R. Allen, J. Vilas and S. V. Beckwith.

HARRIMAN, TENN.—The Harriman, Knoxville & Eastern Railway Company has filed articles of incorporation with a capital stock of $10,000. The company proposes to construct a railway to be operated by steam or electricity in Roane County. The incorporators are: W. A. Rockwell and Henry M. Winslow.

NAPLES, TEX.—The Northwestern Railway Company has been incorporated with a capital stock of $10,000 by Max Kosse and F. T. Atchinson, both of Cincinnati, Ohio. The company proposes to construct a railway to be operated either by steam or electricity from Naples to Sylvania, a distance of 25 miles.

PROVO, UTAH.—Articles of incorporation have been filed for the Knight Power Company, by Jesse Knight, R. E. Allen, J. William Knight, W. Lester Mangum, M. A. Smith, Francis M. Lyman, Jr.; John P. Cahoon, Melvin M. Miller and David B. Brinton. The company is capitalized at $2,000,000. The company owns water power sites in Utah and Wasatch counties.

ELLENSBURG, WASH.—The Falls Power Company has been chartered with a capital stock of $1,000,000 for the purpose of generating and distributing electricity for lamps and motors and to construct and operate electric railways.

ROMNEY, W. VA.—The South Branch Power Company has been incorporated by George H. Johnson, of Romney, W. Va.; John W. Dodd, J. O. Hemson, William Downey and Gray Silver, all of Martinsburg, W. Va. The company is capitalized at $5,000, and proposes to construct a hydro-electric power plant on the South Branch of the Potomac River.

Personal.

MR. C. T. ANDERSON has been appointed manager of the Chicago office, Fisher Building, of the C. W. Hunt Company, New York.

MR. FORREST E. BARKER has been renominated by Governor Draper as a member of the Massachusetts Gas & Electric Light Commission.

MR. H. M. BYLLESBY, of H. M. Byllesby & Co., Chicago, has been elected a director of the Chicago, Milwaukee & Puget Sound Railway Company.

BARON EARNEST F. VAN HERSOLTE, of Arnheim, Holland, has entered the electrical engineering department of the Denver Gas & Electric Company.

MR. G. A. BLUCHER, formerly with the San Antonio (Tex.) Gas & Electric Company, has been made superintendent of the electrical department of the Union Light & Power Company, Fargo, N. D.

MR. R. C. GILLES, Vice-President of the Mount Hood Railway & Power Company, Portland, Ore., has been elected president of the Los Angeles-Pacific Company, to succeed Mr. E. P. Clark, who has resigned.

MR. JOHN W. LIEB, JR., is receiving much benefit from his European visit, which included a stay at Carlsbad until June 17. After a trip to Salzburg and Interlaken he will go to London and arrive in New York about July 26.

MR. FRANK W. McKENZIE, formerly with the Spokane Falls Gas Light Company, and the Washington Water Power Company, Spokane, Wash., has been appointed manager of the Fisher Electric Company, Massillon, Ohio.

MR. JOSEPH A. JANFORD, JR., has been transferred from the New York to the East Liverpool, Ohio, office of the R. Thomas & Sons Company, to assume full charge of the factories of the company at the latter place, and Lisbon, Ohio.

MR. J. C. LAWLER, who has been for seven years the electrical engineer with the Colorado Springs Light & Power Company, has accepted the appointment of superintendent of the operating department of the Gas & Electric Company, of Richmond, Ind.

MR. HERBERT C. BROWN, who has been connected with the Ontario Power Company, the Telluride Power Company, and the Rocky Mountain Bell Telephone Company, has been made superintendent of the Lewiston (Mont.) Coal, Gas and Light Company.

DR. M. EKSTROMER, battery and electrical engineer, has been engaged by the Denver Gas & Electric Company to manage its electric vehicle department. Dr. Ekstromer's duties will be to advise owners of electric vehicles and to increase the private charging station business.

MR. J. B. McCLARY, formerly general manager of the Sheffield Company, at Sheffield, Ala., has been elected vice-president and general manager of the Yolande Coal & Coke Company and the New Connellsville Coal & Coke Company, and president of the Abernant Coal Company, with headquarters at Birmingham, Ala.

MR. J. P. CLARK, formerly assistant to the president of the Michigan United Railways Company, Lansing, Mich., has been elected vice-president and general manager of the Piedmont Traction Company, which has been formed for building an interurban line connecting certain North Carolina mill towns, including Mt. Holly and Gastonia.

MR. J. A. ALLRED, president of the Pennsylvania Water & Power Company, the reorganized McCall Ferry Company, is expected to sail from Liverpool this week. On his arrival it is reported he will take hold of the Consolidated Gas, Electric Light and Power Company, of Baltimore, in which he and his associates are said to have a working majority.

MR. WILLIAM R. W. GRIFFIN, formerly general superintendent of the Rochester & Eastern Rapid Railway Company, the Rochester Railway Company, the Rochester & Sodus Bay Railway Company, and the Rochester & Suburban Railway Company, has been made general manager of the Ohio Valley Scenic Route, composed of the Steubenville and East Liverpool Railway and Light Company, the East Liverpool Traction and Light Company, and the Ohio River Passenger Railway Company, with headquarters at East Liverpool, Ohio.

Obituary.

MR. GEORGE N. EASTMAN.—The many friends and admirers in Chicago and elsewhere will learn with genuine regret of the death of Mr. George Nial Eastman, for several years in charge of the testing laboratory of the Chicago Edison Company, now the Commonwealth Edison Company. Mr. Eastman possessed a keen, analytical mind, and was regarded as one of the brightest men ever engaged in the investigation of scientific electrical problems in Chicago. He was born in Canada about thirty-five years ago, and moved to Michigan at an early age. His collegiate training was obtained at the Michigan Agricultural College, and after graduating, he entered the employment of the Chicago Edison Company in March, 1898. Mr. Eastman was a man of rather delicate physique, and about five years ago his health became impaired. After an extended tour through Europe, he went to California with Mrs. Eastman, where he resided until the time of his death, which occurred on June 14 last. The funeral and burial were held at Riverside, Cal., on June 16. Mr. Eastman was an associate of the American Institute of Electrical Engineers and a member of the Western Society of Engineers of Chicago. He was the author of a number of valuable papers on technical subjects. Some of these attracted wide attention, and his study of the question of the most efficient sizes of carbons for enclosed arc lamps was particularly noteworthy. Among the papers written by Mr. Eastman were the following: "Development of New Forms of Illumination and Their Possible Influence on Central Stations," delivered before the Association of Edison Illuminating Companies, Mount Washington, N. H., Sept. 10, 1902; "Advisability and Methods of Grounding the Neutral on High-Potential Alternating-Current Generators," read before the National Electric Light Association at Boston in May, 1904; "Relation between Length of Arc, Voltage and Candle-Power in Enclosed Arc Lamps, and the Effect upon Efficiency of Arc Lamps by Varying the Size of Carbons," read before the Association of Edison Illuminating Companies, New Castle, N. H., Aug. 31, 1904; "Protection and Control of Large High-Tension Alternating-Current Distribution Systems," presented before the International Electrical Congress in St. Louis in September, 1904.

Mr. Geo. N. Eastman.

Trade Publications.

INSULATING MATERIALS of all kinds are briefly outlined in a folder of the Mitchell-Rand Manufacturing Company, 88 Maiden Lane, New York.

ELECTRIC IRONS are described in an enthusiastic manner in a folder issued by the Pacific Electric Heating Company, 560 Washington Bldg., Chicago.

INCANDESCENT LAMPS, including carbon, tantalum and tungsten types, are listed in a folder issued by the Consolidated Electric Lamp Company, Danvers, Mass.

TRANSFORMERS.—Numerous views of stationary transformers for all services are shown in a loose-leaf catalogue issued by the Pittsburgh Transformer Company, Pittsburgh, Pa.

FIBER CONDUIT, for underground electric conduits, is illustrated, described and listed in bulletin No. 11,952 of the H. W. Johns-Manville Company, 100 William St., New York.

PRESSURE GOVERNORS, for maintaining the proper pressure of air for car-braking systems, are described in bulletin No. 390 of the National Brake & Electric Company, Milwaukee, Wis.

STEAM CONDENSERS.—High-vacuum surface condensers for use with steam turbines are well described and illustrated in bulletin No. 106 of the Wheeler Condenser & Engineering Company, Carteret, N. J.

WOOD PRESERVATION.—A wood-preserving paint, said to be "coppered carbolineum," is discussed at length in a booklet issued by the Anthracenol Wood Preserving Company, 264 Spring St., New York.

CONTRACTORS' SUPPLIES, including "everything from a hand shovel to a steam shovel," are illustrated, listed and described in a 44-page catalogue issued by the Contractors' Supply & Equipment Company, Denver, Col.

STORAGE BATTERIES.—The development of the lead-plate storage battery is well outlined in a booklet issued by the Electric Storage Battery Company, Philadelphia, entitled, "The Story of the Storage Battery."

ELECTRICAL MACHINERY.—A well-executed catalogue, containing an interesting and comprehensive list of available electric and steam machinery, has been issued by the John A. Stewart Electric Company, Cincinnati, Ohio.

AMP.-HOUR METERS, designed especially for indicating the condition of charge and discharge of a vehicle battery, are appropriately discussed in a well-illustrated booklet issued by the Sangamo Electric Company, Springfield, Ill.

RAPID ENGINEERING CONSTRUCTION.—The Stone & Webster Engineering Corporation, Boston, Mass., is distributing a neatly executed card calling attention to its facilities for rapidly executing any engineering construction contract.

ELECTRIC HEARING.—The H. G. Pape Electric & Manufacturing Company, Buffalo, has issued an illustrated booklet devoted to the "Auristophone," which is a telephone device designed to correct defective hearing or enable the deaf to hear.

COAL-CONVEYING MACHINERY.—In its booklet No. 95, the Link-Belt Company, Philadelphia, gives illustrations and brief descriptions of coal tippler, retarding conveyors, car hauls, coal washers and various other types of conveying machinery for coal mines.

WIRING CONDUIT, of the rust-proof, non-corrosive type, is treated in a convincing manner in an illustrated folder of the National Metal Molding Company, Pittsburgh, Pa., giving a long list of names of buildings in which "Sheraduct" has been installed.

STREET LAMP REFLECTOR.—Bulletin No. 6 of the Benjamin Electric Manufacturing Company, 120 Sangamo St., Chicago, deals with parabolite reflectors for series tungsten street lighting equipments designed so as to direct the light to the most useful locations.

STEAM CONDENSERS.—Bulletin No. 1071 of the Allis-Chalmers Company, Milwaukee, Wis., relates to jet type condensers so arranged that vacuum can be formed or recovered with full-load on the turbine. The condenser is so designed that all of the condensing apparatus is

placed beneath the turbine. Barometric condensers are discussed in bulletin No. 1070 of the same company.

FANS AND BLOWERS.—The American Blower Company, Detroit, Mich., has issued an interesting bulletin (No. 283) on fans and blowers, in which the history, theory and construction of Sirocco fans is treated in an instructive manner. The illustrations show the construction and types of fans adapted for steam engine, steam turbine and electric motor drives and varying in size from tiny window ventilators to immense blowers for mine ventilation.

ARC LAMPS.—Much interesting information concerning the operating characteristics of flaming arc lamps is contained in a pamphlet issued by the Excello Arc Lamp Company, New York. After outlining the development of flaming arc lamps, and describing the present types, a discussion is given of certain illuminating engineering data showing to what extent the flaming arc lamp is preferable to the ordinary carbon arc lamp for illuminating extended areas.

ELECTRIC HARDENING FURNACE.—The General Electric Company has issued bulletin No. 4737, illustrating and describing an electric furnace designed for the hardening or tempering of tool steel. In the operation of this furnace, metallic salts are brought to a liquid state by passing electric energy into them, and the heating of the tool to be hardened can be exactly controlled and kept uniform throughout over a wide range of temperature. The bulletin contains sectional views of the furnace, diagrams of electrical connections, as well as a chart showing the power required to operate it.

ALTERNATORS.—The Western Electric Company has issued bulletin No. 5210, describing in detail alternators for belt, engine and water-wheel drives, with and without directly connected exciters. This bulletin contains more than the usual number of illustrations and shows in detail the steps taken in the building up of the various parts of the alternators described. It contains illustrations of parts of the whole as well as photographs of the completely assembled machine. The reading matter discusses rather fully the merits of and the reasons for the several kinds of construction used throughout the lines of alternators described therein.

PORTABLE TEST WATT-HOUR METER.—The simplest and most practicable method of testing watt-hour meters in place under working conditions is by comparison with a standard or precision watt-hour meter. The Duncan Electric Manufacturing Company, Lafayette, Ind., has issued a bulletin (No. 10) describing its portable test meter, in which are given the theory of operation, the construction, and the method of using the instrument. The meter is constructed according to the same principles as the regular Duncan meter, except that all possible care is taken to render it absolutely accurate, and then auxiliary devices are added to adapt it to testing purposes. It is equipped with a diamond jewel bearing; the indicating mechanism consists of a pointer fastened rigidly to the upper end of the shaft and a two-dial counter; the entire mechanism is set back to zero as easily as a stop watch, thus making subtraction of readings unnecessary. To adapt it to different loads the meter is equipped with a number of series coils connected to contacts arranged at the back of the meter; by turning a cylindrical controller down different combinations of series and parallel connections are made. The handle of the controller plays over a dial on which are marked numbers corresponding to the full-load amperes.

BUSINESS NOTES.

THE MOORE ELECTRICAL COMPANY, of 169 Malvern Street, Newark, N. J., has changed its name to Moore Light Company.

THE CROCKER-WHEELER COMPANY announces the change of address of its Boston Office from 4 Post Office Square to Boston Safe Deposit & Trust Company Building, Devonshire and Arch Streets.

ATLANTIC INSULATED WIRE & CABLE COMPANY, 120 Liberty Street, New York, has appointed Mr. Samuel D. Gloss, formerly with the Simplex Electrical Company, sales manager to succeed the late Mr. George F. Porter.

THE DONGAN ELECTRIC MANUFACTURING COMPANY, of Albany, N. Y., manufacturer of switchboard and portable electrical measuring instruments, has recently opened a branch office at 1303 Empire Building, Birmingham, Ala., in charge of Mr. L. M. Robertson.

THE PENBERTHY INJECTOR COMPANY, Detroit, Mich., has announced that its output of automatic injector has reached the unprecedented total of 600,000. It is estimated that these injectors, operating simultaneously, could handle 340,000,000 cu. ft. of water per hour, or one-third as much water as the flow.

THE C. W. HUNT COMPANY, NEW YORK, builder of coal handling, conveying and hoisting machinery, has opened offices in the State Bank Building, Richmond, Va., and also at 607 Rhodes Building, Atlanta, Ga., with Mr. W. F. Lee, for several years preliminary engineer to the company, in charge.

THE ELECTRIC ECONOMY COMPANY, 64 Warren St, Roxbury, Mass., has made a contract with The National Electric Equipment Company, of Boston, by which it acquires the exclusive right to manufacture and sell National shock absorbers for tungsten lamps heretofore made and sold by the National Company.

THE ELECTRIC WELDING PRODUCTS COMPANY, Cleveland, Ohio, has now moved into its new factory addition, 94 x 100, three stories high and has installed new machinery, adding very largely to its capacity. The number of men employed approximates 350. The company caters particularly to the automobile and parts manufacturers, as well as generally to the manufacturers of machinery, etc.

HOLOPHANE PHILADELPHIA OFFICE.—The Holophane Company, of Newark, Ohio, has recently opened an office in the Stephen Girard Building, 21 South Twelfth St., Philadelphia, in order to have the services of the company always at the disposal of the architects, fixture houses and jobbers of that city. Mr. Nelson B. Hazeltine, formerly with the New York Edison Company, is in charge of the office. Mr. F. E. Mansfield, Pennsylvania representative of the Holophane Company, continues to look after the trade of jobbers and contractors.

GARWOOD AGENCIES.—Garwood Electric Company has appointed the Varney Electrical Supply Company, 235 South Meridian Street, Indianapolis, Ind., its agents in the territory covering that portion of Indiana south of a line drawn east and west through Fort Wayne, except Bedford and within a radius of ten miles of Bedford, and to that portion of Kentucky bounded on the east by a line drawn north and south through Frankfort and including Frankfort, and on the west by a line drawn north and south through Henderson and including Henderson. It has also appointed the Electrical Manufacturers' Sales Company, of Denver, Col., as its agents in the territory covered by Colorado, Wyoming, Utah, New Mexico and eastern half of Idaho.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 21, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

961,776. ELECTRICAL MEANS FOR OPERATING CLOCK PENDULUMS; J. F. Holmes, Waterbury, Conn. App. filed July 27, 1909. A block of insulating material with an elliptical groove to guide a pin attached to an arm on the pendulum and a magnet for throwing the pendulum rod at each complete swing.

961,786. TROLLEY-WHEEL GUARD; H. L. Miller, St. Louis, Mo. App. filed Sept. 21, 1909. A pair of plates on opposite sides of the harp pivotally mounted with upward projections.

961,805. ELECTROMAGNET; C. Scott, Yonkers, N. Y. App. filed July 30, 1906. A paper spool carrying spiral windings and saturated with insulating material.

961,815. TELEPHONE RELAY OR REPEATER; L. W. Southgate, Worcester, Mass. App. filed March 3, 1902. Includes a coil, a microphone, having two electrodes, and a third unattached electrode actuated by magnetic variation in the field of the coil.

961,826. ELECTRICALLY PROTECTED PLATE AND LINING FOR VAULTS, SAFES, ETC.; J. P. Williams, New York, N. Y. App. filed March 18, 1909. An electro-thermostatic wire carried by the plate and connected to an alarm circuit.

961,827. ELECTRIC CABLE FOR BURGLAR-ALARM SYSTEMS; J. P. Williams, New York, N. Y. App. filed March 18, 1909. An electro-thermostatic cable with a thermostatic core and wires exterior thereto and around the same and connected in multiple and to a signal circuit.

961,842. CONTROLLING DEVICE FOR MECHANICAL MOVEMENTS. C. H. Carter, Brooklyn, N. Y. App. filed April 28, 1905. For switch blades in which a resilient switch bar is held by a catch having a holding portion and a guide co-operating with said catch to flex said bar.

961,853. FIRE-ALARM SYSTEM; J. H. Garratt and W. J. McGivern, Rochester, N. Y. App. filed Feb. 2, 1905. A line circuit and a source of current connected therein within a signaling instrument and electromagnetically operated devices responsive to the line current for connecting the signaling device with the actuating means.

961,855. DETECTORIUM; H. Gernsback, New York, N. Y. App. filed Feb. 5, 1910. Means for tuning and for acting as a detector, being a sliding contact for tuning—coil tipped with a material to form the detector.

961,884. ATTACHMENT FOR COMBINATION DIALS ON SAFES, VAULTS, ETC.; M. Mosler, New York, N. Y. App. filed May 17, 1909. A lamp for lighting the combination lock thrown into action by turning the tumblers.

961,891. RECHARGEABLE ELECTRIC FUSE; A. J. Orell, Longbeach, Cal. App. filed Feb. 21, 1910. A rechargeable fuse. Details.

961,912. METHOD OF HEATING CARBON; F. J. Tone, Niagara Falls, N. Y. App. filed Feb. 4, 1907. The method of heating carbon by forming an electric arc within a charge of carbonaceous material, thus heating the material by transmission of heat from the arc.

961,913. REDUCTION OF REFRACTORY COMPOUNDS; F. J. Tone, Niagara Falls, N. Y. App. filed March 21, 1907. The process of reducing ores of aluminum by reducing it to a carbid, and then reducing the carbid.

961,914. WIRELESS LIGHTING SYSTEM; E. B. Tustin, Jr., Bloomsburg, Pa. App. filed April 1, 1908. For lighting a series of lamps by wireless which actuates an electrical circuit closer for the lighting circuit.

961,924. PROCESS OF REFINING GOLD; H. Wöhlwill, Hamburg, Germany. App. filed March 10, 1909. Electrolizes a solution of a

gold salt by passing a non-symmetrical, alternating current therethrough with a gold anode.

961,937. ELECTRIC WATER-HEATER; W. F. Cutler, San Francisco, Cal. App. filed July 8, 1909. A heating chamber carrying a series of cup-shaped insulators, each containing coils. The liquid is admitted to the heating chamber.

961,945. METHOD OF MANUFACTURE OF BICARBONATE OF SODA; R. H. Forsythe Finlay, Belfast, Ireland. App. filed July 17, 1908. Improvement on the Solvay process by electrolizing the mother liquor in the cathode chamber of a cell separated by one or more diaphragms from the anode chamber which is filled with a sodium salt solution for recovering ammonia.

961,962. PROTECTIVE DEVICE; J. D. Hoffman, Duke, Oklahoma. App. filed Sept. 21, 1909. Protects from sneak currents by means of a self-contained protector containing a plurality of pairs of spaced plates with a pair of electrodes between each pair of plates. Details.

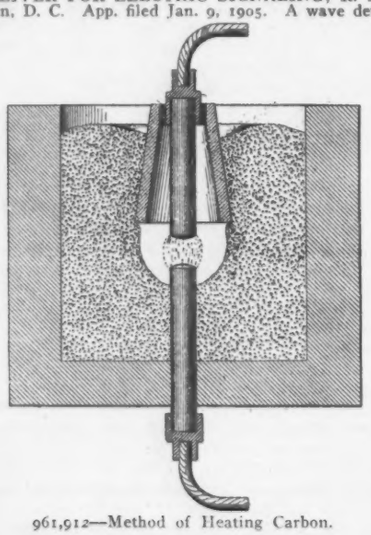
961,978. ELECTRICAL CONDENSER; R. H. Manson, Elyria, Ohio. App. filed May 29, 1907. A metallic casing with insulated cover and a split metal condenser terminal, one split part being the terminal for the condenser and the other for the electric circuit.

961,984. APPARATUS FOR BONDING RAILS; W. A. Neff, Cleveland, Ohio. App. filed June 22, 1908. A truck movable on the track and carrying a supporting member which carries a vertical member, the latter carrying an electrode by a pivotal connection.

962,013. METALLURGICAL FURNACE; S. Z. De Ferranti, Grindleford Bridge, near Sheffield, England. App. filed June 10, 1907. For circulating or mixing the molten metal, including a lower chamber in which the molten metal collects and iron masses and multiphase windings normal to the free surface of the metal.

962,014. METHOD OF ELECTRIC SIGNALING; R. A. Fessenden, Washington, D. C. App. filed Jan. 9, 1905. For wireless waves by producing a bubble in a body of liquid by the action of the waves and utilizing the movement of the bubble to give a signal.

962,015. RECEIVER FOR ELECTRIC SIGNALING; R. A. Fessenden, Washington, D. C. App. filed Jan. 9, 1905. A wave detector consisting of a constricted conducting fluid path with means for producing a bubble therein.



961,912—Method of Heating Carbon.

962,016. RECEIVER FOR ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed March 16, 1906. A liquid barretter having two fine terminals, a large terminal and an electrolyte.

962,017. ELECTRICAL APPARATUS; R. A. Fessenden, Brant Rock, Mass. App. filed April 18, 1906. A receiver for electromagnetic waves having a coil the ratio of whose self-induction to its mass is greater than one hundred thousand, with a movable element controlling a local circuit.

962,018. METHOD OF SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed Oct. 10, 1907. Transmits waves continuously, except for interrupting them to represent dots and dashes and reinverting the signals at the receiving station by causing the interruptions only to be sensible.

962,033. COMBINED BATTERY RECEPTACLE AND BELL SUPPORT; J. L. Koeber, Houston, Tex. App. filed Jan. 5, 1909. A casing for batteries which houses the batteries and provides a sounding board for the bell.

962,040. APPARATUS FOR ELECTRICAL TREATMENT OF ORES; W. B. McPherson, Los Angeles, Cal. App. filed April 20, 1909. A tank with a central electrode, a hollow outer concentric electrode with means for passing a heating medium through the outer electrode and a rotating stirrer.

962,055. ELECTRIC FIXTURE; G. F. Rush, Chicago, Ill. App. filed Sept. 15, 1909. Porcelain fixture with a lining member and dome of insulating material.

962,063. STRAIN RELIEF FOR LAMP SOCKETS; F. A. Swan, Cliftondale, Mass. App. filed May 4, 1908. The insulated body has an open groove to receive the wire, which groove is provided with portions extending in different directions so that the wire occupying the groove will have a circuitous course and an enclosing shell fitting over the body and closing the grooves.

962,071. ELECTRICAL CONNECTION; M. J. Wohl and H. Hertzberg, New York, N. Y. App. filed Nov. 26, 1907. A tap having complimental sections united by a bolt and provided with a wiring chamber between the socket and the terminal chambers.

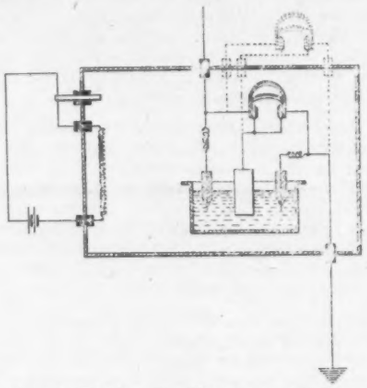
962,082. PRINTING TELEGRAPH; T. M. Foote, Allston, Mass. App. filed July 23, 1908. An independent printing wheel parallel to the main printing wheel, one printing the title and the other the quotations, and a third wheel for printing the numbers of past quotations.

962,101. ALTERNATING-CURRENT COMMUTATOR MOTOR; R. Richter, Charlottenburg, Germany. App. filed Jan. 15, 1907. Has an armature and a grooved stator with auxiliary windings in series and in shunt to the armature to neutralize the reactance and transformer tensions in the short-circuited coils of the armature.

962,106. ELECTRICAL SYSTEM OF DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed April 10, 1909. Car-axle lighting system having a safety fuse between the main generator and pole changer to prevent short circuiting of the battery.

962,113. AUTOMATIC GAS IGNITION AND CONTROL; L. G. Bartlett, Somerville, Mass. App. filed Sept. 24, 1909. For controlling lights in an automobile from the seat.

962,129. ELECTROMAGNETIC DEVICE; W. A. Crowdus, Chicago, Ill. App. filed Feb. 1, 1909. An electric circuit with a circuit breaker with which a movable magnet co-operates and a magnetic body movable in the field of the magnet actuates the magnet.



962,016—Receiver for Electromagnetic Waves.

962,222. ELECTRICITY METER; D. C. Jackson, Madison, Wis. App. filed Feb. 12, 1906. Wattmeter, overcoming the variations with temperature by means of a resistance coil of copper so that the magnetic field of the pressure coils deviates slightly from quadrature with the main line pressure as the temperature changes.

962,261. ELECTRICAL PIANO; R. A. Rose and G. F. Holbrook, Santa Rosa, Cal. App. filed March 29, 1909. Solenoids operate cores which strike hammers, the latter striking the strings.

962,262. WAVE DETECTOR FOR WIRELESS TELEGRAPHY; W. Schloemich, Berlin, and P. F. Pichon, Sudende, near Berlin, Germany. App. filed April 14, 1906. Two contact bodies, one of manganese compounds.

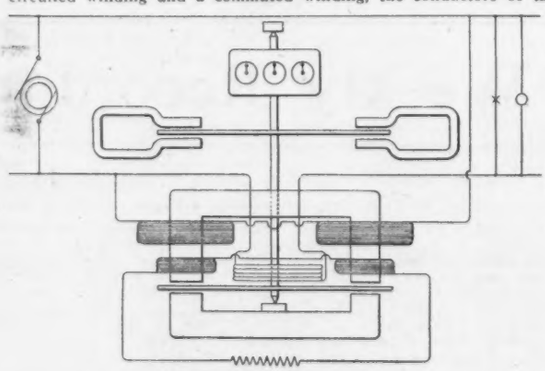
962,263. SECONDARY BATTERY; H. P. Schreiber, London, England. App. filed July 13, 1909. Positive electrode of lead alloy tube pasted inside with oxide of lead face. The negative electrode consists of a smaller tube pasted outside with lead paste, placed concentrically in the positive electrode.

962,268. CHAIN-GEAR STEERING APPARATUS; A Sundh, Yonkers, N. Y. App. filed Jan. 14, 1908. For steering rudders of ships by electromechanical steering mechanism.

962,294. WATER HEATER; J. R. Armington, Roanoke, Va. App. filed July 9, 1909. A tubular casing with a heating element therein, having resistance wire and a switch box carried by the cap with a switch within the box.

962,334. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, England. App. filed July 3, 1909. Has a stator with two displaced groups of laminations and a laminated rotor with a permanently short-circuited winding and two commuted windings.

962,335. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, England. App. filed July 9, 1909. A rotor with a permanently short-circuited winding and a commuted winding, the conductors of these two windings lying adjacent to each other on one half of the rotor, being displaced from each other on the other half.



962,222—Electricity Meter.

962,336. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, England. App. filed July 9, 1909. For starting and stopping single-phase induction motors by means of a rotor with a permanently short-circuited winding and a commuted winding, the former extending over all the rotor laminations and the latter over a part only.

962,337. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, England. App. filed July 9, 1909. A rotor with two groups of laminations, a commuted winding on each group, the windings being interconnected at a plurality of points, and means for reversing the current to one of the stator windings.

962,365. TROLLEY; G. A. Lefley, West View, Pa. App. filed Sept. 24, 1909. A pole section with a circular rack on the frame of the car and a yoke section connected to the pole section and having a pawl connected to the pole section and engaging the rack for limiting the movement of the pole section with stirrup connected with the pole.

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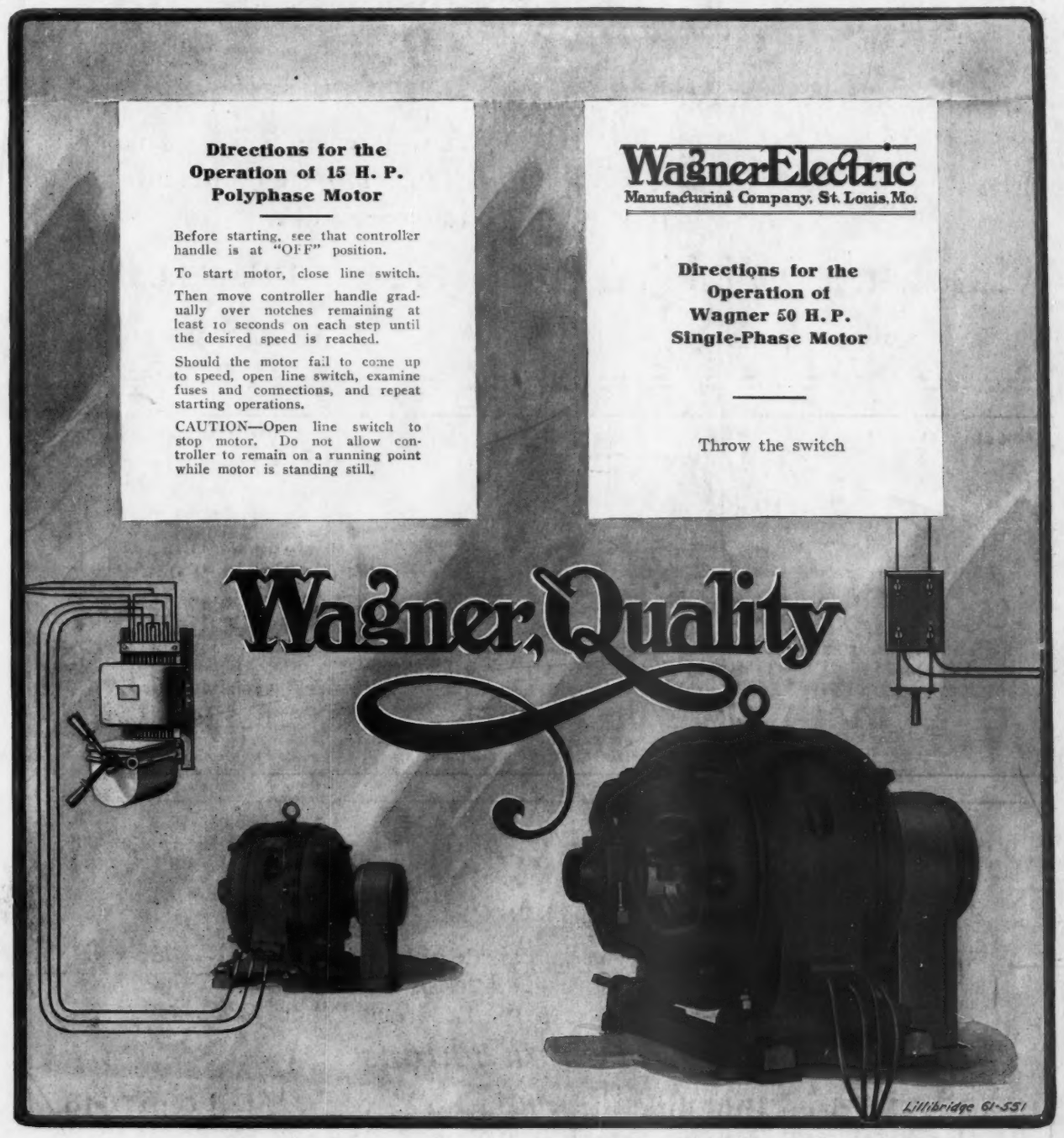
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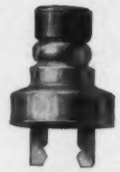

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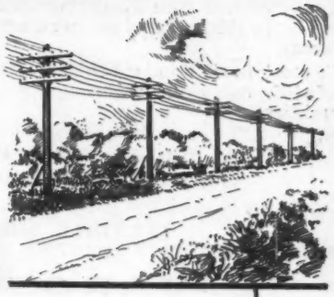

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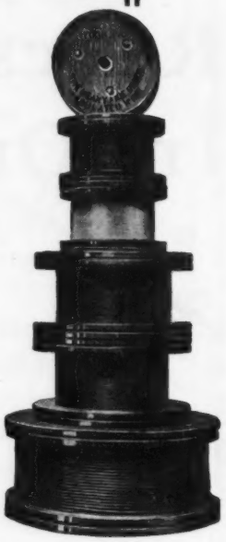

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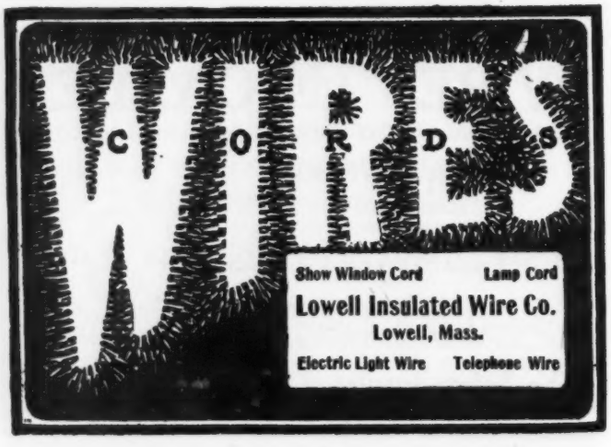

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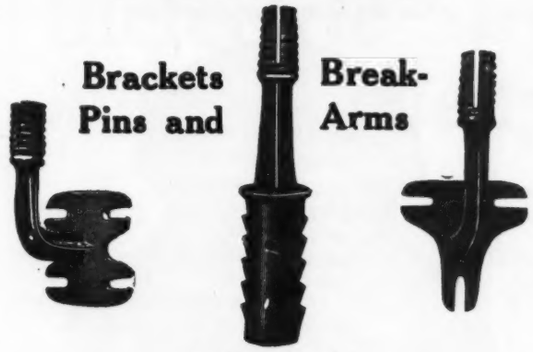

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The adjustable screw ends and triangular fastenings are some of the special features that have found favor with electric light and telephone companies. Our catalog explains fully. Get it.

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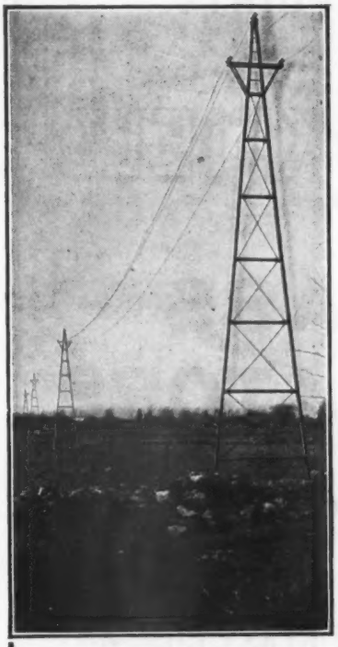
Steel Transmission Structures



The cut shows a line of semi-flexible transmission structures recently erected by the Rochester Railway Company. This line is a reconstruction of an 11,000 volt wooden pole line ten years old. In many cases a line of these steel structures can be erected at close to the same cost as the cost of a wooden pole line.

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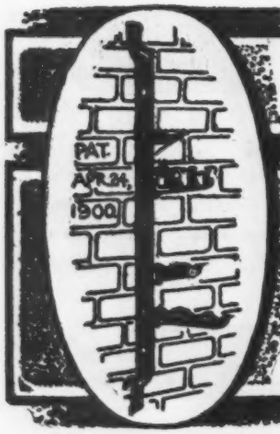

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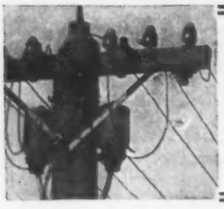

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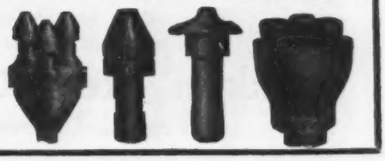

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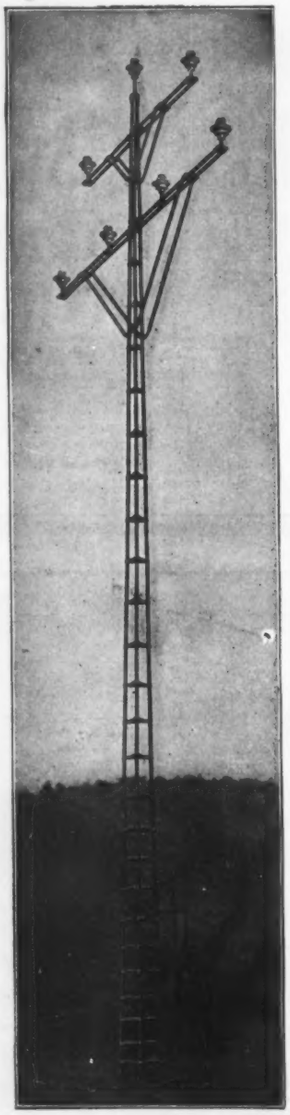

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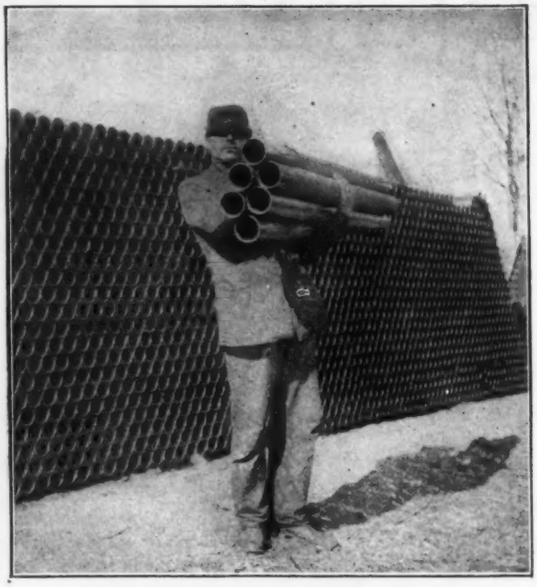

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can be laid practically twice as rapidly as other forms of conduit.

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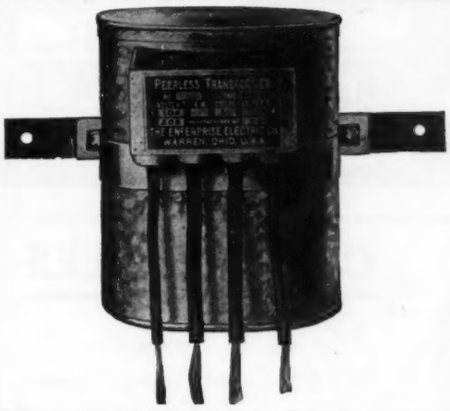

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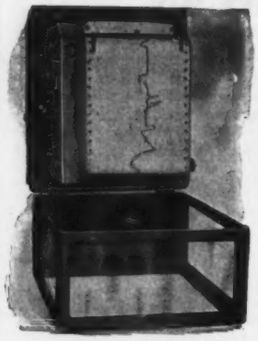

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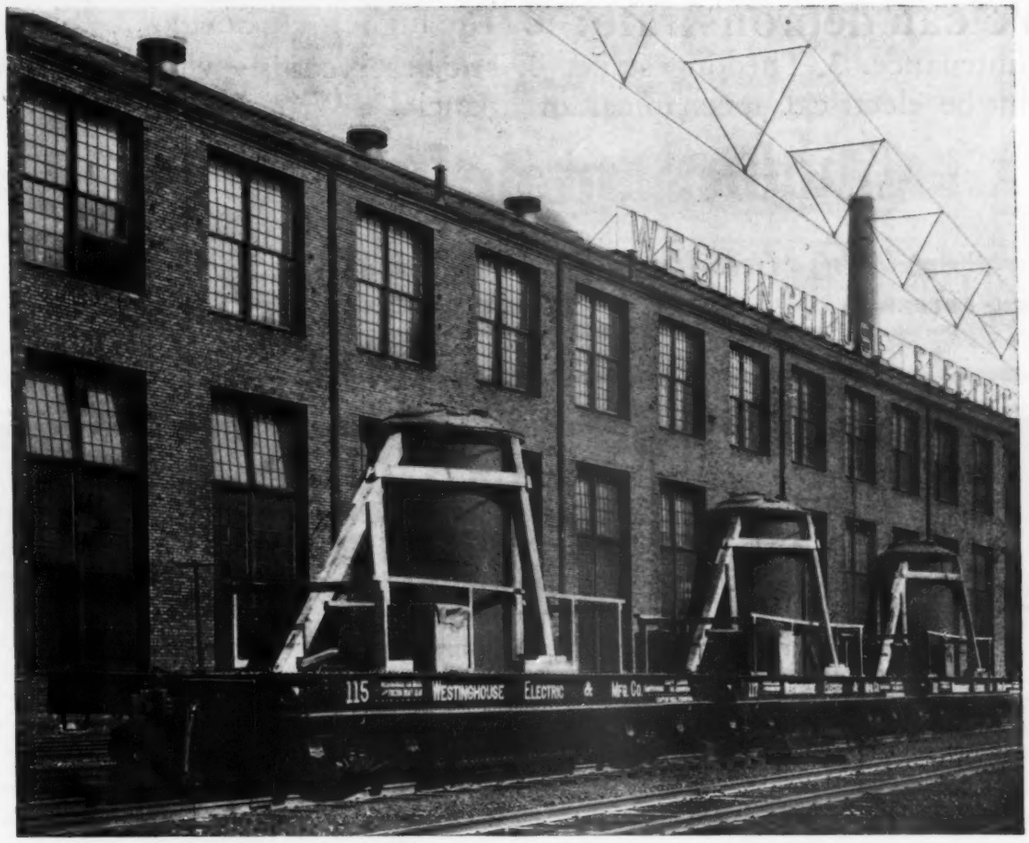

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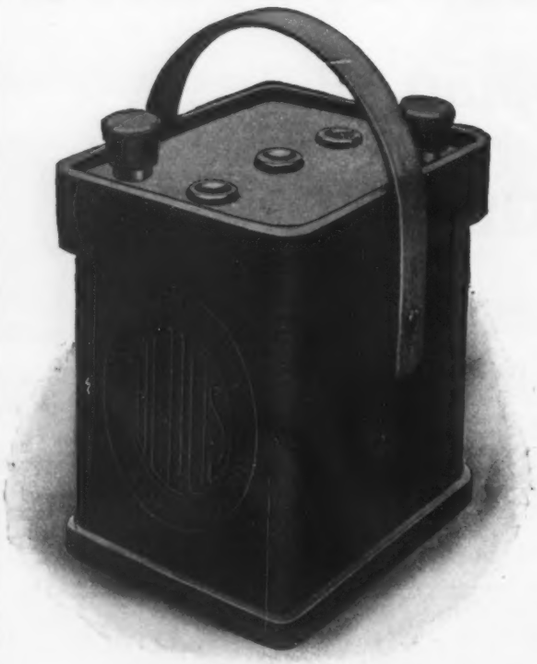

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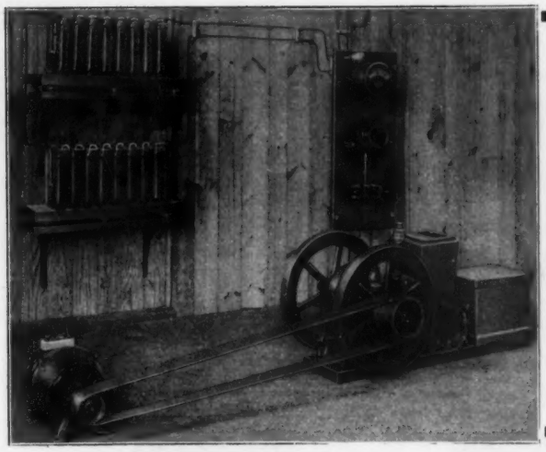

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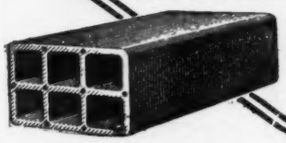

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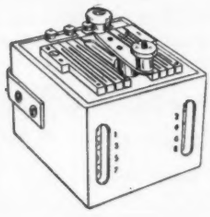

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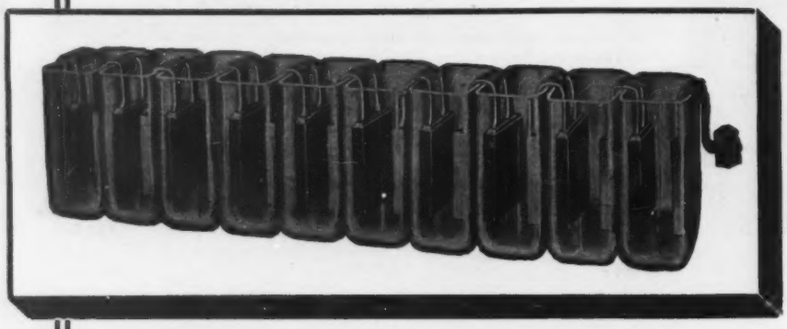

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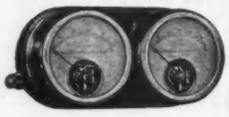

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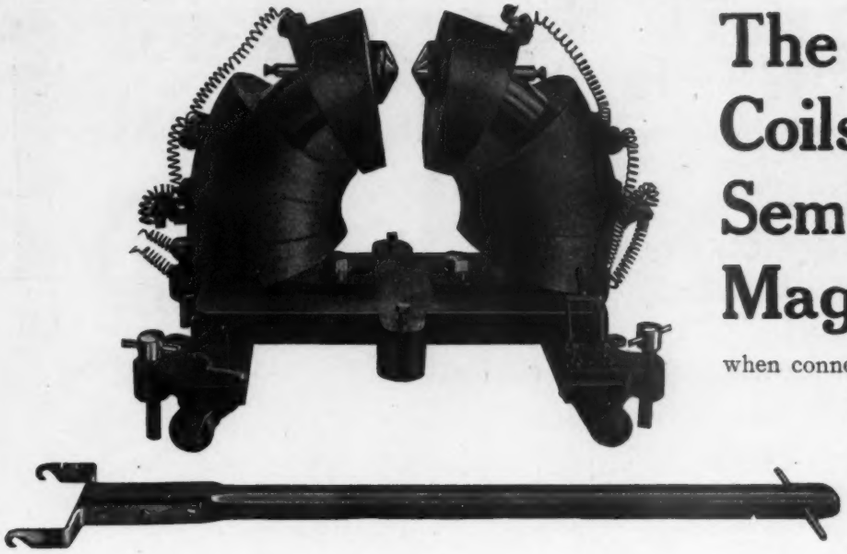

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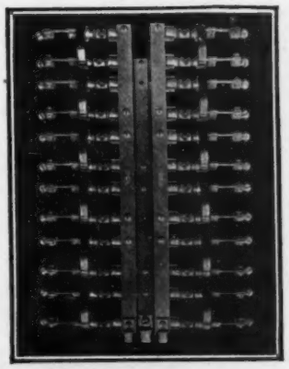

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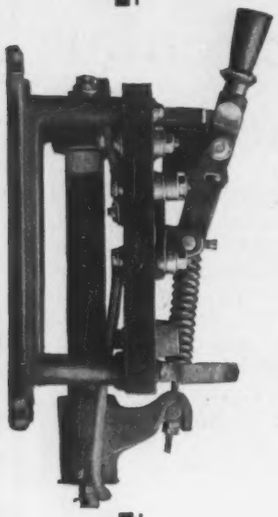

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6-30-'10

Frahm Frequency Meters

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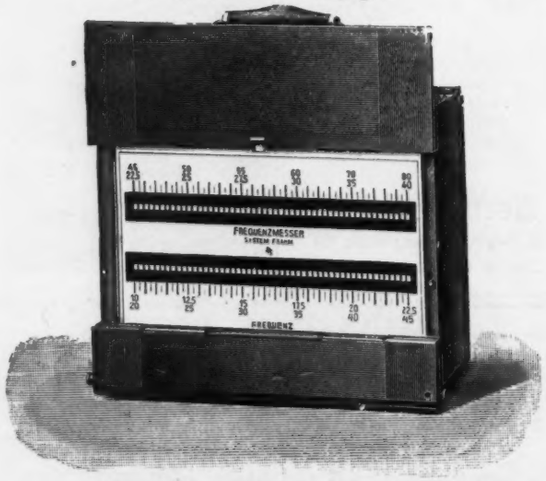

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Frahm Frequency Meters are supplied for any range between 7½ and 140 cycles. Portable instruments can be used on any voltage from 50 to 300 and may be fitted with device to double the range.

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that are really waterproof

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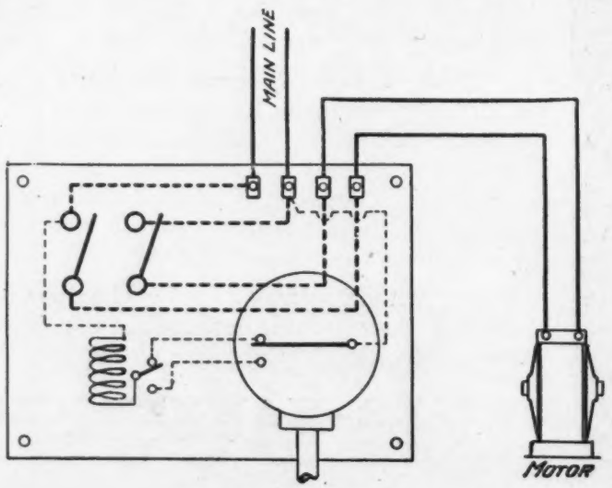
IN WRITING MENTION THIS JOURNAL

This Diagram Shows How Simple It Is



to wire up a Sundh Pressure Regulator for starting a small motor without the use of a starting resistance.

The double pole type of Pressure Regulator is shown, but in many cases of Direct Current and single-phase Alternating Current, a single pole type can be used. It may be also adapted for starting A. C. Motors of two or three phases, three wire, or two phases, four wire when it is permissible to open two circuits and to run the neutrals direct to the motor.

The Sundh Catalog contains detailed information. Shall we send it?

SUNDH ELECTRIC COMPANY

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2

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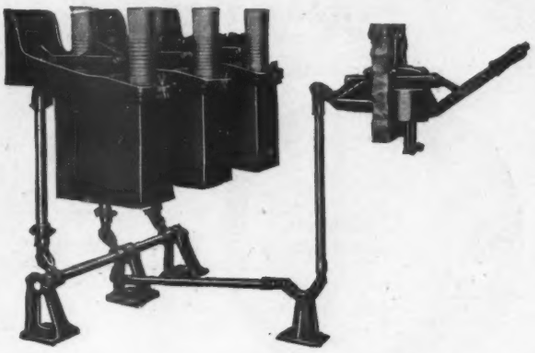

and have in operation oil switches up to 3,000 amperes capacity.

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are fitted from end to end. They cost *us* more than the castings used by other makers, but the increase of conductivity is worth it. Write for the catalog.

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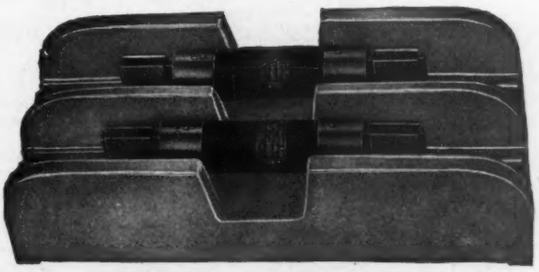

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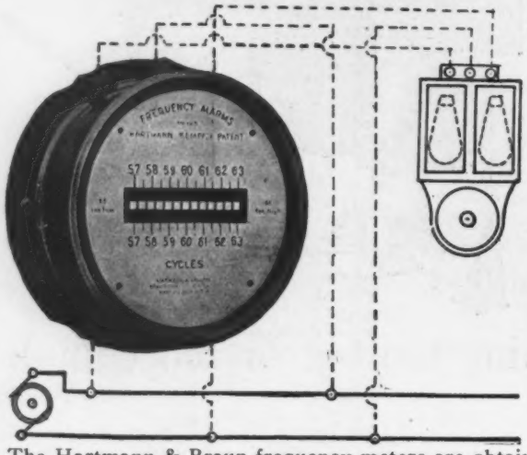
ALARM TYPE



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This attachment in no way interferes with the regular working of the instrument as an accurate frequency indicator.

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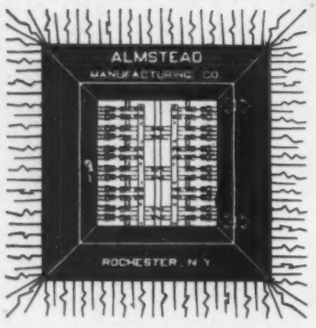

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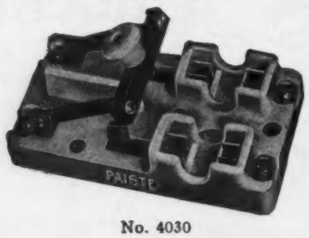

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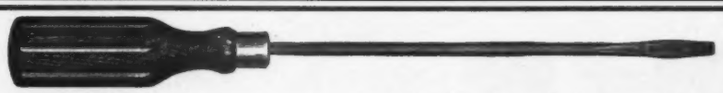

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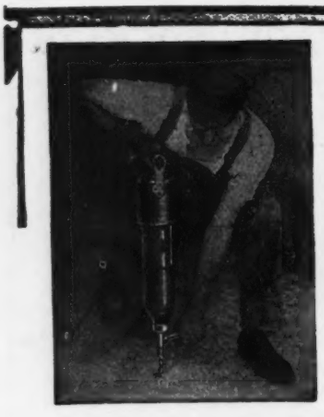

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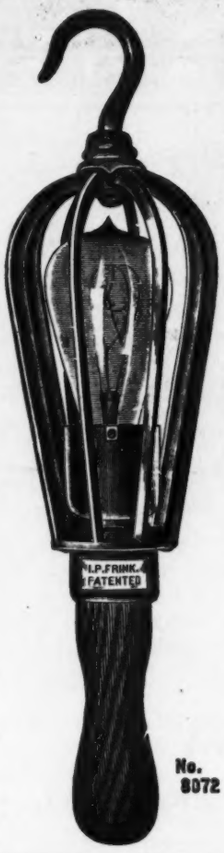

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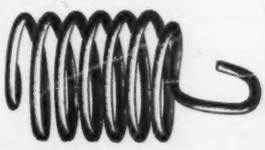

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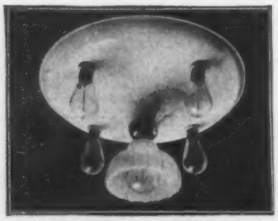

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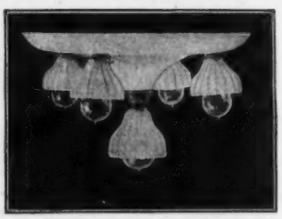

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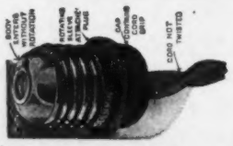

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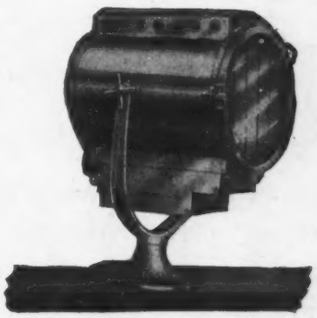
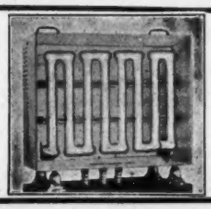
228 E. Clifton Avenue
Cincinnati, Ohio



Send for Catalog "A"



THE MOORE LIGHT
"Comes in Long Vacuum Tubes."
YELLOW LIGHT The Best Illumination for Large Areas.
WHITE LIGHT A Duplication of Daylight. The Only Light for Color Matching.
THE MOORE LIGHT WINDOW is factory-built. Send for description.
MOORE LIGHT CO., Newark, New Jersey

W. R. OSTRANDER & CO.
Manufacturers
ELECTRIC BELLS
ANNUNCIATORS
SPEAKING TUBES, ETC.
ELECTRIC LIGHT SUPPLIES
Factory, 1433-1439 De Kalb Ave., Brooklyn 22 Dey St., New York

INNER ARC GLOBES
INCANDESCENT BULBS & TUBING
Write for Prices. The Lippincott Glass Co., Alexandria, Ind.

Bryan-Marsh Mazda lamps mean more customers, better satisfied customers, and better returns for the central station. They cut the cost of getting business and hold the business you get.

Candle-power maintenance unsurpassed, filaments tougher and stronger than any other type of metal filament lamp, efficiency never compassed by any incandescent lamp on the market.

Insist on Bryan-Marsh lamps—there's a difference.

A lamp for every service, best service for every lamp—Mazdas, Tantalums, Gems, Imperial Carbons, Mazda and Carbon Miniatures.

Agents all over the map—one near you. Tell the nearest one to send you his most tempting proposition.

Bryan-Marsh Co.

Chicago, Ill. Central Falls, R. I.

The Largest Exclusive Manufacturers of Incandescent Lamps

New York Minneapolis Denver San Francisco

The Heany Tungsten Lamp Burns In Any Position

PATENTS PENDING

With equally efficient service.

It is the most perfect lamp on the market.

Will stand rough handling without breakage or displacement of filament

Has twice the life of a carbon lamp, and gives a perfect white light without deterioration in quality. Saves 75 per cent. in current.

Write for prices.

THE HEANY LAMP CO.

1733 Broadway New York

For Difficult Work in Tight Corners, Use The Baby Torch

—the smallest practical torch on the market. Lights with a match, and gives a powerful blast. Needs no pumping, and burns three hours with one filling. Regular price $1.25. Upon receipt of $1.00, we will send a sample torch, charges prepaid.

The Crescent Co.

514 W. Monroe St., Chicago

Factory: Valparaiso, Ind. 3

NON-DETERIORATING POLISH

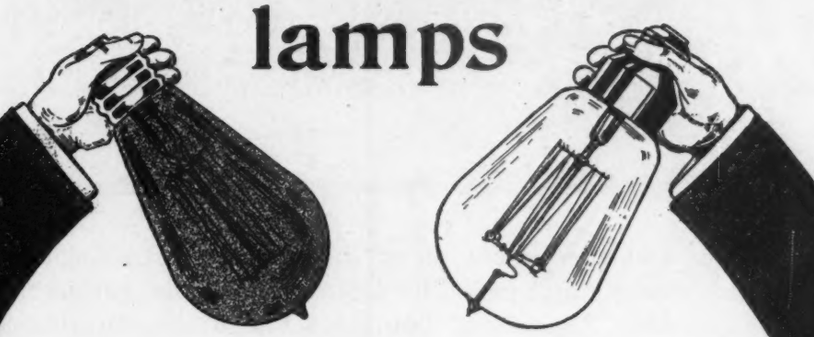
and an easily applied, quickly working polish. The shine lasts. Cannot Damage metal. Samples are free. 3 oz. box, 10c. 5 lb. pail, $1.00. Highest award Chicago, '93; St. Louis, '04. Agents and dealers all over the world.

GEO. W. HOFFMAN, Manufacturer

205 E. Washington St., Indianapolis, Ind. 1

If advertising contains sufficient information to pay the reader to read it, you can make the advertisement long enough to tell your whole story and be sure of it being read.

Here's the difference in metal-filament lamps



The bulb on the left will be familiar to those who have used ordinary metal-filament lamps. The blackened bulb has been all too common. Notice how clear the other bulb is. This is an example of

"Z" LAMPS

They cannot blacken

"Look for the Chemical on the Stem"—that prevents it. It is covered by "Z" Lamp patents and can be used in no other lamps. 1,000 hours at 1¼ w.p.c. "Z" lamps stand more rough usage than any other metal-filament lamp made. Try a lot on approval.

18-watt Lamps up to 130 volts, 25 to 250 watts up to 250 volts.

Write for prices

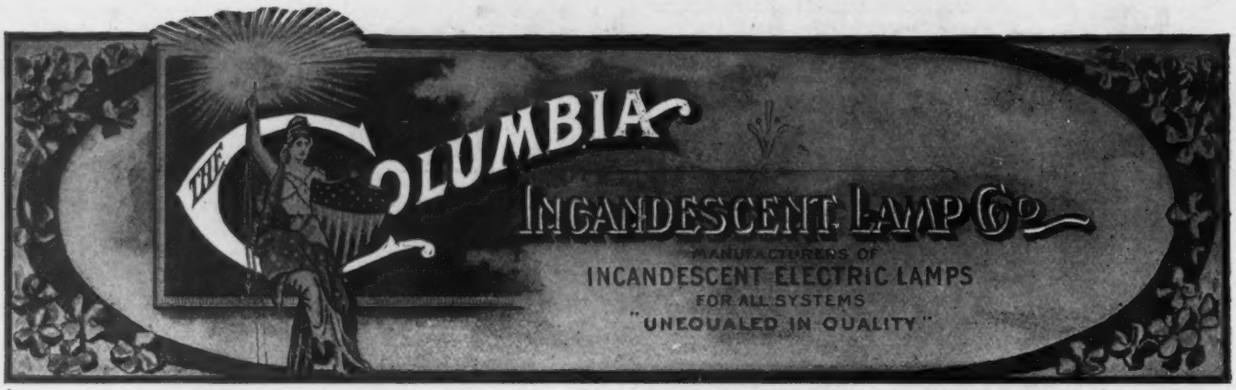
American "Z" Electric Lamp Co.

Absolutely Independent

Sales Offices: Singer Tower, New York City.

We need no license—our patents are better.

Canadian Agents: Chapman & Walker, Ltd., 69 Victoria St., Toronto; 429 Coristine Bldgs. Montreal.



WE offer you the benefit of our facilities for furnishing all types of incandescent lamps including, **Columbia Mazda (tungsten filament), Columbia Tantalum, Columbia Carbon, Columbia Miniature, both carbon and Mazda, Columbia Mazda street series, etc., etc.** Prompt shipments. Courteous treatment. We solicit your orders through 1910.

THE COLUMBIA INCANDESCENT LAMP COMPANY
(Established in 1889)
Main Office and Works: ST. LOUIS, MO.

BRANCH OFFICES:

Boston, No. 178 Devonshire St.
New York, Suite No. 406, No. 225 Fifth Ave.
Philadelphia, No. 1221 Real Estate Trust Bldg.
Chicago, No 264-270 Fifth Ave.
Minneapolis, No. 248 Security Bank Bldg.
Memphis, Randolph Bldg.
Dallas, No. 1501-2 Praetorian Bldg.
San Francisco No. 155 New Montgomery St.

Large and well assorted stocks carried at all of the above branch offices

Corinthian Post for Street Lighting

These posts are set 75 to 90 feet apart and weigh 1150 pounds. They are lighted with Tungsten burners and give wonderful results.

Height from sidewalk to top of center globe 14 feet 7 inches.

These posts are used exclusively in Duluth, Jacksonville, Winnipeg, Savannah, Minneapolis and many other cities.

Write for booklets and further information.

Flour City Ornamental Iron Works.
MINNEAPOLIS, MINN.

Corinthian Standard Design
Patent No 39759

2046 J.

TUNGSTEN POSTS

For Street Lighting

ARC LAMP POLES, BRACKETS

Ornamental Lighting Posts for all purposes

We have just what you require among our thousand different models.

We manufacture all posts used for N. Y. City lighting.

Catalogues and special designs on application.

Correspondence solicited

The J. L. Mott Iron Works
118-120 Fifth Ave., New York City

Cat. No. 9961, with Hook

Mechanical Strength of O-B Arc Lamp Hangers Assures Public Safety

because cap casting and porcelain Insulator are made with flanges which *lock together*, and the Insulator is securely cemented into cap casting.

For full description see page 110, New Railway Catalog No. 8.

Let us quote on your next requirements.

We also make—

O-B Hi-Tension Insulators for all voltages.

THE OHIO BRASS CO.

MANSFIELD, OHIO, U. S. A.

WARD LEONARD

Ventilating Fan Controlling Panels

Panels giving 50% armature speed control—15% field speed control. No-voltage release (across the line), double pole overload circuit breaker and fuses.

In Chicago you may inspect this apparatus in the Blackstone Hotel, City Hall, Union League Club, McCormick Bldg., etc.

In every other city where high-class consulting engineering work is being done—these panels are used exclusively.

When you buy a motor driven fan don't take "what is thrown in" with it. Specify the best—it will not cost more.

Send for Catalog.

The Finest Rheostats made.

Handsome Appearance.

You can pay more—you cannot buy more

WARD LEONARD ELECTRIC CO. **Bronxville, N. Y.**

You Know What You Want

You Get It in Electra Carbons

ELECTRA

TRADE MARK

Write for prices. All orders are filled on a "rush" schedule

HUGO REISINGER

Sole Importer of Electra Carbons

11 Broadway **NEW YORK**

2

"Stave" Flaming Arc

One of the **Real Reasons** of our **Success.**

One of our customers writes that the cost of repairs for **400 Lamps** for **ten** months was **less than** fifteen dollars.

You can't ask for anything better than that.

STAVE ELECTRICAL COMPANY

27 West 27th Street, NEW YORK

1101 Monadnock Block, CHICAGO

New England Agents:

STUART HOWLAND CO., BOSTON

BRANCHES IN ALL PRINCIPAL CITIES

A NEW THOUGHT
ABOUT FLAMING CARBON SERVICE

It should be of great value to you as an operator of flaming lamps to know——

That the citizens on the streets recognize the brighter and better light from flaming lamps that are trimmed with Silvertip;

That the treasurer of the company using Silvertip notices a great reduction in the cost of flaming carbons because Silvertip prices are lowest;

That the trimmers recognize the greater ease and speed with which they can trim their lamps when they use Silvertip;

That the superintendent admits a superiority of lamp service with Silvertip trims.

We, also, notice the general appreciation of all these people and these various conditions by the unusually rapid growth in orders for Silvertip flaming carbons.

Silvertip is a patented tip carbon of highest development yet attained in the manufacture of flaming carbons. It will burn in any good lamp of whatever make, and we stand back of its service-giving qualities.

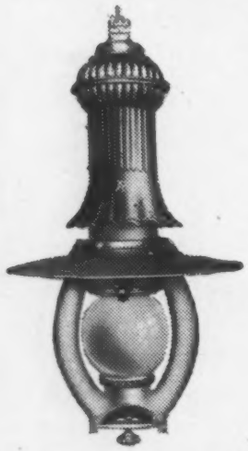
Give us a chance to prove our statements and position by making tests of Silvertip with others. We will stand the expense of Silvertip samples delivered.

NATIONAL CARBON COMPANY CLEVELAND OHIO

For Street Lighting

The light distribution of a lamp is most important.

The Regenerative Flaming Arc Lamp



gives maximum candle power at an angle of 30 degrees below the horizontal. You can place the lamps low and further apart and still have an even distribution. Life of carbon 70 hours—extremely simple in construction.

Write for Bulletin 87

The Adams-Bagnall Electric Co.

New York Office: 143 LIBERTY ST. — CLEVELAND OHIO — Chicago Office: 303 DEARBORN ST.

R. E. T. Pringle, Room 209, Eastern Township Bank Bldg., Montreal, P. Q., Canada

The cheapest is not necessarily the least expensive.

Initial cost is the only expense incurred when installing

"EXCELLO" Flaming Arcs

THE EXCELLO ARC LAMP COMPANY

H. M. HIRSCHBERG, President

CHICAGO 617 W. Jackson Boulevard — NEW YORK 30-32 East 20th St.

BOSTON 184 Franklin St.

"Delco"
Laundry and Tailor Irons

These are neat and rugged in appearance and stand up to their work indefinitely. They will not burn out even if left running over night. Their large storage effect will permit good work twenty minutes after current is cut off. Irons are furnished with or without three-heat switch on back.

Write for catalog which also lists "Delco" electric ranges, combination sets, "Delco" soldering irons, solder pots, glue pots, chafing dishes, percolators, ovens, air heaters, etc.

Diamond Electric Co.
Binghamton, New York

TRADE DELCO MARK

Ask about "Delco" Electric Ranges.

HOSKINS
TRADE MARK REGISTERED

—*The Cheerie* **TOASTOVE**

uses *our patented* Nickel-Chromium resistance element to produce its radiant glow. *No other* domestic heating device on the market is thus protected.

Our attractive booklet tells why the TOASTOVE is in such demand for Summer use. *Write to-day*

HOSKINS MANUFACTURING COMPANY
Electric—Furnaces, Pyrometers and Heating Appliances
467 Lawton Avenue, DETROIT. 150

The Records Show

that the intense, steady light of

AUROLA Flaming Arcs

tends toward the production of more work and better work in workshops, printing establishments, railway terminals, etc.

Minimum attendance and ideal distribution make them THE lamps for large interiors.

Write for Aurola literature

Charles L. Kiewert Co.
New York: 39 Cortlandt St.

Milwaukee: 114-116 Huron St.
San Francisco: 195-7 Fremont St.
Chicago: 112 So. Clinton St.
Kansas City: 1511 Grand Ave.
Pittsburgh, Pa.: 421 Frick Bldg.

The "IMPERIAL"

A Portable Vacuum Cleaning Machine combining efficiency, practicability and economy. Can be attached to any electric light socket.

"The Only High Grade, Efficient Machine on the Market." Guaranteed.

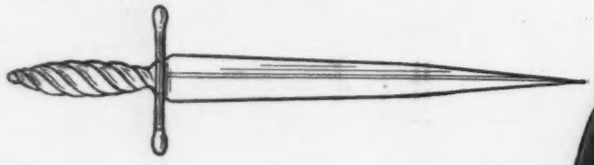
A Dividend Payer for Central Stations

Growing concerns and responsible parties wanted for agents. Exclusive territory given. Send for catalogue and particulars. Manufactured in two sizes.

PRICES, $100 and $75, COMPLETE

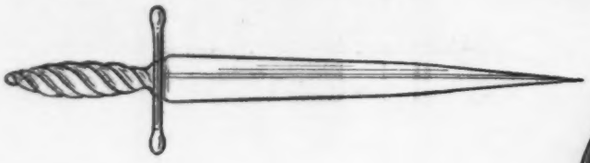
EMPIRE VACUUM COMPANY
112 West 30th Street, New York
Chicago Office: 702 Postal Telegraph Building

Look for the
HOLOPHANE STILETTO



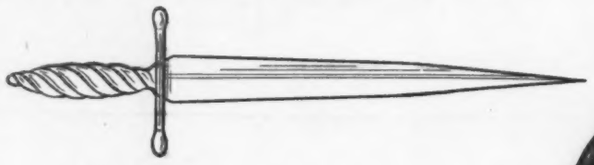
Extensive Type Standard Reflector

a New and
DISTINCTIVE FEATURE



Intensive Type Standard Reflector

of the NEW
STANDARD LINE
HOLOPHANE REFLECTORS



Focusing Type Standard Reflector

Holophane **STANDARD LINE** Reflectors for Mazda and Tungsten Lamps are new—different—better.

They are a great improvement over the older "high efficiency" lines, embodying new principles of design and construction.

They are more attractive in appearance and of better efficiency than any popular line we have yet offered.

Their distinguishing feature is the new Holophane Stiletto prism (see cuts) which is large at the top and gradually tapers to a point at the Reflector's edge.

Holophane **STANDARD LINE** Reflectors are ready July 1st. Bulletin now ready.

HOLOPHANE COMPANY

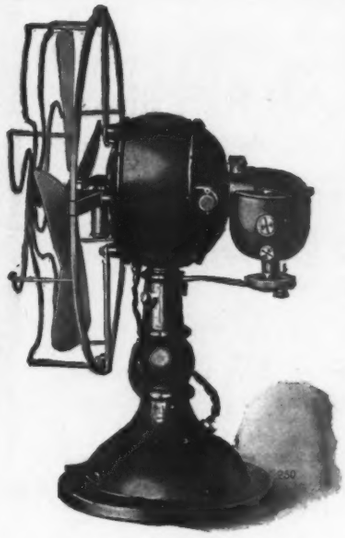
Sales Department

NEWARK, OHIO

New York Boston Philadelphia Chicago San Francisco

Diehl
TRADE MARK

Universal Swivel and Trunnion Fans



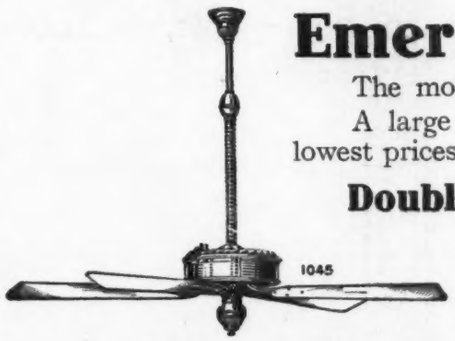
Universal Oscillator Fans Ceiling Fans

No. 236 Universal Oscillator Fan

SEND FOR BULLETIN No. 24

Diehl Manufacturing Co., Elizabethport, New Jersey

Branches: NEW YORK PHILADELPHIA BOSTON CHICAGO WILLIAMSPORT, PA.



Emerson A. C. Fans

The most durable and satisfactory made.
A large stock for immediate shipment at lowest prices.

Doubleday-Hill Electric Co
PITTSBURG, PA.

Southern Warehouse: Charlotte, N. C.
Electrical Supplies for Electric Light Co.'s, Electric Rys., Electric Contractors. Telephone Co.'s, Mills, Mines, Etc.

One of the largest electrical stocks in the world.

The Only Way to Really Know

about an electric washer is to try one. Don't conclude that you have seen the best machine until you have tried the "Automatic."

All we ask is the chance to send you a trial machine.

Are you willing?

AUTOMATIC ELECTRIC WASHER CO.
NEWTON, IOWA

Emerson 8-inch Induction Fans

The 8-inch fan with the trunnion!

Makes a bracket fan with no extra parts.

Emerson oil-tight dust-proof bearing.

Immediate shipments from a big stock.

The Emerson Electric Mfg. Co.
2024-2032 Washington Ave. St. Louis, Mo.
Eastern Address, 50 Church St. New York City

Ask the Man Who Tests Them

He can tell you some things about meters that you won't learn from advertising or salesmen.

He may not be able to explain why but he can tell you which meters are always accurate. no matter where they are located. Which ones are most substantially built and last longest.

Nine cases out of ten he will say they are

Fort Wayne Wattmeters

and they cause the least trouble and the fewest kicks from the consumers.

These points are all worth considering when you buy meters, especially as they don't cost any thing extra.

If you want to know the reasons why our meters are so popular with the man who tests them and the consumer, send for our Bulletin B-1053

We had it printed to convince men just like you and we will send it free as soon as we hear from you.

Fort Wayne Electric Works

1409 Broadway, Fort Wayne, Indiana

Atlanta	Grand Rapids	New Orleans	St. Paul
Boston	Madison	Pittsburg	St. Louis
Cincinnati	Milwaukee	Philadelphia	San Francisco
Chicago	New York	Seattle	Syracuse

HERE AT LAST

NO WIRING NECESSARY

"RICHMOND" PORTABLE BATTERY FAN

Patented

RUNS 50 HOURS

Recharged same as other storage batteries.

Invaluable for the sick room.

Guaranteed

Only Portable Storage Battery Fan outfit in the market. Weighs but 25 lbs. complete.

9-inch sells for $17.50
12-inch sells for 25.00

We manufacture the "HIRSCH" Storage Battery for sparking, lighting and other purposes. Strongest and best Storage Battery made.

LONG RUN—LONG LIFE.

Write for catalogue and discounts. Liberal discount to the trade.

The Portable Battery Fan Co.

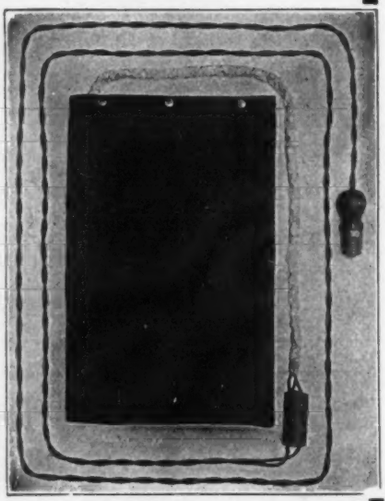
Offices and Works:

13th and Callowhill Sts., Philadelphia

AGENTS WANTED

Easy to Sell—Stays Sold

SHALER ELECTRO-PAD



is conceded to be the perfect heating pad. For home—hospital—traveler, it has many advantages — so flexible that it can be placed in any position, even wrapped around the wrist or ankle—so light (10 oz.) that it can be used where other appliances would be unbearable—so constructed that overheating is impossible, as the thermostat cuts out the current at 180°F. The three-way ball bearing switch permits of low, medium or high heat. Half of this switch rotates on the other half instead of having to be pulled apart and stuck together again to make contacts. It has no flat springs to break, no projecting parts to catch on the clothing or bedding. The heating coils are wound on asbestos cord and cannot kink or break.

Every SHALER ELECTRO-PAD is furnished with 15 feet of flexible conducting cord, a silk or rubber detachable cover and a neat plug that can be screwed into any socket without twisting the cord.

SHALER ELECTRO-PADS can be used for city current of any voltage from 50 to 125 volts.

Write today for full technical description, or, better yet, order a sample pad and get our attractive agency proposition. We furnish electrotypes and printed matter to help you make sales.

C. A. SHALER COMPANY, Waupun, Wis.

Manufacturers of the famous Shaler Vulcanizers for automobile tires.

Mr. Central Station Man: Our campaign is your campaign

You want your present consumers to buy more current. You want new consumers. You want more houses wired. All these objects are being accomplished by our selling campaign on behalf of the

"RICHMOND" Suction Cleaner

Read the virtues of the "RICHMOND". We're spending thousands of dollars to make these merits known to the public. WE'RE putting the Cleaner into any home for trial. Our $3,000,000 company stands back of our guarantee.

Points About the "RICHMOND" Suction Cleaner

—costs less per month for electricity than the average family spends for brooms.
—after a year of consistent use you couldn't find a thimbleful of dirt in a fourteen-room house if you took all the carpets up.
—no more spring or fall 'house-cleanings"—no more "sweeping days"—no more "dusty Fridays."
—its total cost is less than the cost of one single annual house-cleaning—to say nothing of saving the wear and tear which house-cleaning brings to furniture.
—cleans furniture, walls, upholstery, bedding, clothing, decorations, book shelves, tile floors, hardwood floors, nooks and crannies, as well as making old carpets look like new.
—equally valuable in homes, offices, stores, hotels, hospitals, libraries, schools, churches, theatres, public buildings.
—without any change or adjustment, uses either direct or alternating current; universal motor of our own construction.
—thirty feet of electrical cord, with connecting socket, comes with the cleaner—everything ready to start—anyone can do it.
—handsome in appearance—all exposed parts are highly polished—operates with easy gliding motion, no pressure required.
—absolutely guaranteed for one year, and without abuse should last as long as a watch.

Now we want to work hand in hand with you Central Station men. Your profits are as big as ours on the deal. Yet we finance the actual selling work, printed matter, local advertising and so on. You're called on for a little help to reap a big profit—for yourself—for your plant.

Use the coupon and you'll get our plan to help you at once.

E.W. 6-30-10
Send Central Station Plan to
.....
.....
.....

THE McCRUM-HOWELL CO.
General Offices:
Park Avenue and 41st St., New York

Give Your Customers This Iron

The heating element is of wire fused to the bottom in enamel. No air space to retard the heat downward, but a large air space above keeps the top cool. Every inch of the heating surface is effective. ¶ A Simplex Iron sold to a customer brings satisfaction from the start—leads to sales of other devices. ¶ The best of material and workmanship is put into every Iron and carries with it, wherever it goes, a Simplex Guarantee for Quality. ¶ We not only manufacture Irons of the highest grade, but every device that can be heated by electricity. Let us help you solve your customers' heating problems with apparatus that will satisfy.

This Trade Mark SIMPLEX QUALITY Stands For Goods Made On Honor

SIMPLEX ELECTRIC HEATING CO.

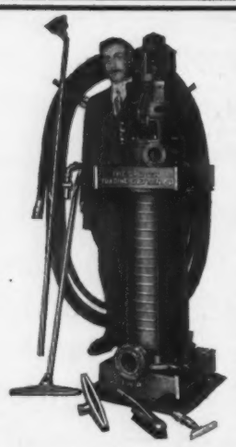
Cambridge, Mass.

Monadnock Block, Chicago.

No. 612 Howard Street, San Francisco, Cal.

WRITE FOR BOOKLET "G"

The Spencer Turbine Cleaner



is a permanently installed vacuum cleaning outfit for those who have big sweeping problems: schools, which must be quickly and thoroughly cleaned daily; office buildings, stores, hotels, and public institutions. It is also for house owners who appreciate the healthfulness of perfect cleanliness and can afford to have the best. It is not for those who are looking for small portable toy cleaners to solve their sweeping problems.

It is the perfected vacuum cleaning installation, as hundreds of thoroughly satisfied users in all parts of the country will gladly testify.

The expense of installing the SPENCER Cleaner is minimized by its durability, efficiency, simplicity, and low cost of operation. It pays for itself over and over again in its saving of labor, time, floor coverings, and doctors' bills.

Write for our free Catalogue, fully illustrating and describing the SPENCER Turbine Cleaner.

The Spencer Turbine Cleaner Co.

Hartford, Conn.

Branch Offices or Selling Agencies in All the Principal Cities

METROPOLITAN ELECTRICAL SUPPLY CO.

MANUFACTURERS IMPORTERS AND DEALERS IN

Everything Electrical

184 LAKE STREET

CHICAGO

Simplicity of Construction,

Plenty of Heat,

Even Distribution of Heat,

Attractive Appearance,

High Quality,

Low Price,

Satisfaction to the user on the ironing board,

Are all combined in the

"American"

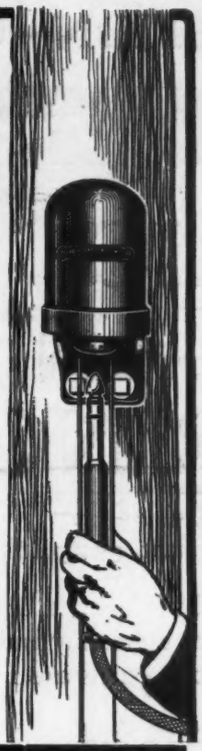
Superior (6-s) Electric Iron. Six Pounds.

Write us for our special proposition on your annual requirements.

No. 882 IRON CLAD JACK BOX

¶ Inclement atmospheric conditions and rough usage have no effect upon this waterproof jack box. ¶ The cast iron dome unlocks from the frame mounting with one turn—permanently locked with a dowel pin and switch lock. ¶ A spring trap door covers the opening for incoming connecting plug and prevents insects of any kind getting in between the contacts. ¶ Contact springs and lightning arrester fuses are separately mounted vertically on either side of frame. ¶ Every terminal or connecting wire lead is heavily insulated by soft rubber bushings. ¶ Washers and lag screws for mounting furnished. ¶ A half inch diameter three conductor plug No. 46 is part of this superior equipment.

PRICE FOR BOTH, $5.25



STROMBERG-CARLSON TEL.MFG.CO
ROCHESTER, NEW YORK, U.S.A.
CHICAGO, ILL. KANSAS CITY, MO.

Bill Writes To Sam

Letter No. 3

PEEWAUKEE ELECTRIC LIGHT & POWER CO.,
PEEWAUKEE, June 23, 1910.

DEAR SAM:—

I knew you would make them sit up. I never saw a soldering job yet that a Vulcan iron would not do better, faster and cheaper than any other iron on the market. The manufacturers here tell me they cut costs in half and increase production tremendously.

I understand from your letter of the 22nd, that your dry goods merchant wants you to recommend to him some electric speciality to sell. That is a natural result of a lot of calls he has been getting, of course.

The Vulcan Electric Heating Company of Chicago make a hair-curling iron that is a crackerjack! Being electrically self-heated, with plug and cord attachment, it doesn't burn or scorch the hair. There are two styles for personal and professional use, $3 and $7, retail. We have always done well selling Electrocurls ourselves for commencement, wedding and holiday presents.

And as to that canning factory down the river, Vulcan Electric Can-Capping Tools are known to be the best all over the world. They are adapted to multiple power capping machines. We sold a lot to some paint canners here and they say they have cut costs and increased output right from the start.

Just had a letter from the Vulcan Electric Heating Company, Chicago, today and am enclosing same to you. You can see they are good people to deal with.

Very truly yours,

PEEWAUKEE ELECTRIC LIGHT & POWER CO.

Dictated by Bill
to Gwendolyne

Letter written by Bill Jenkins, owner of the Peewaukee Electric Light & Power Co., to his brother, Sam Jenkins, owner of the Allagazan Electric Light & Power Co.

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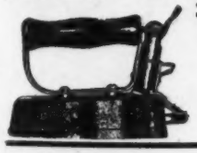

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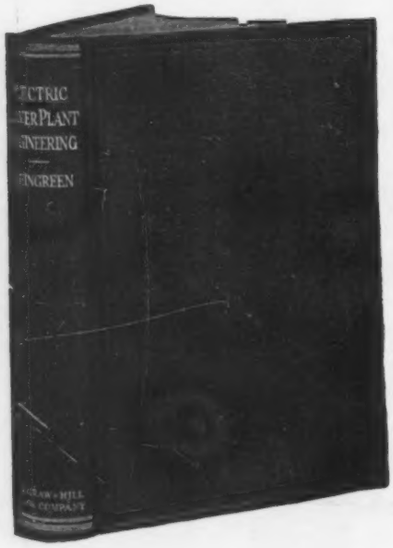

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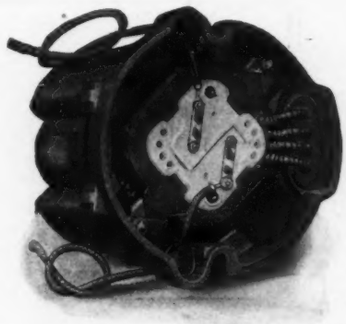

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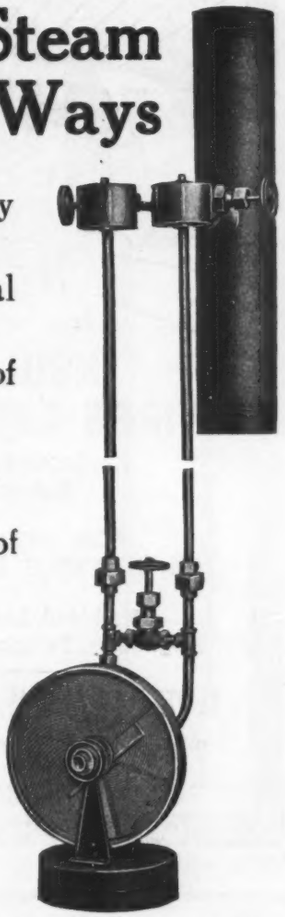

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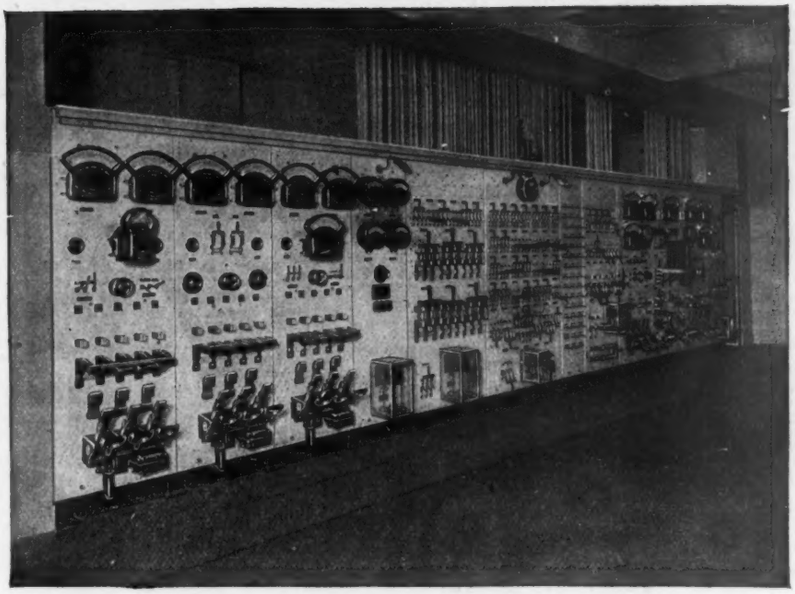

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American Conduit Mfg. Co.
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Key Engineering Co., Ltd.
National Metal Molding Co.
Sprague Electric Co.

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American Vit. Conduit Co.
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Monolithic Conduit Co.
National Conduit & Cable Co.
Wyckoff Pipe & Creosoting Co.

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American Electric Fuse Co.
Crocker-Wheeler Co.
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Monitor Sales Dept.
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Sears, Henry D.

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Struthers-Wells Co.
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American Blower Co.
Ball Engine Co.
Ball & Wood Co.
McIntosh, Seymour & Co.
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Westinghouse Machine Co.
Wisconsin Engine Co.

EXPERIMENTAL APPARATUS
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Esterline Co.
Roller-Smith Co.

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Century Electric Co.
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Electric Bond & Share Co.
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Benjamin Elec. Mfg. Co.
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Ball & Wood Co.

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Campbell Electric Co.

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Johns-Manville Co., H. W.
Massachusetts Chemical Co.

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Condit Electrical Mfg. Co.
D. & W. Fuse Co.
Johns-Manville Co., H. W.
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Ostrander & Co., W. R.
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Jenkins Bros.

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Phœnix Glass Co.

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Holophane Co.
Lippincott Glass Co.
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Phœnix Glass Co.

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Dixon Crucible Co., Joseph.
International Acheson Graphite Co.

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Green Engineering Co.

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Hubbell, Inc., Harvey.
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Standard Underground Cable Co.

HEATERS, FEED WATER.
Alberger Condenser Co.
Harrison Safety Boiler Works.
Platt Iron Wks. Co.

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Green Fuel Economizer Co.

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American Elec'l Heater Co.
Diamond Electric Co.
General Electric Co.
Hoskins Mfg. Co.
Pacific Elec. Heating Co.
Pelouze Electric Heater Co.
Simplex Electric Heating Co.
Vulcan Electric Heating Co.
Woods, Jr., C. D.

HEATING, STEAM.
American District Steam Co.

HIGH-SPEED DRILLS.
Cleveland Twist Drill Co.

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Allis-Chalmers Co.
Maris Bros.
Sprague Electric Co.

HOISTS, MAGNETIC.
Electric Controller & Mfg. Co.

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Shaler Co., C. A.

HOUSE CLEANERS, ELECTRIC.
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McCrum-Howell Co.
Spencer Turbine Cleaner Co.

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Pelton Water Wheel Co.

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Carlisle & Finch Co.

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INJECTORS.
Jenkins Bros.

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Atwater-Kent Mfg. Co.
Biddle, J. G.
Bristol Co.
Columbia Meter Co.
Connecticut Telep. & Elec. Co.
Eldredge Elec. & Mfg. Co.
Esterline Co.
Fort Wayne Electric Works.
General Electric Co.
Gurley, W. & L. E.
Hoyt Elec'l Inst. Works.
Keystone Elec. Instrument Co.
Leeds & Northrup.
Pignolet, Louis M.
Queen & Co., Inc.
Roller-Smith Co.
Sangamo Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.
Weston Elec'l Inst. Co.

INSULATING CEMENT.
Massachusetts Chemical Co.

INSULATING MACHINERY.
Buffalo Foundry & Mach. Co.
New England Butt Co.

INSULATING MATERIAL.
China and Porcelain.
Colonial Sign & Ins. Co.
Hartford Faience Co.
Imperial Porcelain Works.
Locke Insulator Mfg. Co.
Ohio Brass Co.
Pittsburgh High Vol. Ins. Co.
Star Porcelain Co.
Compounds, Paints and Varnishes.
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Massachusetts Chemical Co.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.
Ohio Brass Co.
Standard Varnish Works.
Sterling Varnish Co.
Composition, Cloth and Paper.
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Central Electric Co.
Clark Elec. & Mfg. Co.
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General Electric Co.
Imperial Porcelain Works.
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Locke Insulator Co.
Mica Insulator Co.
Ohio Brass Co.
Pittsburgh High. Vol. Ins. Co.
Sears, Henry D.
Star Porcelain Co.
Western Electric Co.

INSULATORS, GLASS.
Brookfield Glass Co.
Hemingray Glass Co.
Locke Insulator Mfg. Co.
Ohio Brass Co.

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Watson-Stillman Co.

JOINTS, EXPANSION.
Alberger Condenser Co.

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Dossert & Co., Inc.

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Helios Mfg. Co.
Kiewert Co., Chas. L.
Stave Electrical Co.
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Bryan-Marsh Co.
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Heany Lamp Co.
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Anderson Mfg. Co., A. & J. M.
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Clark Electric & Mfg. Co.
Electrical Const. Supply Co.
G. & W. Elec. Spec. Co.
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Ohio Brass Co.
Pacific Elec. & Mfg. Co.
Stromberg-Carlson Telep. Mfg. Co.
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International Acheson Graphite Co.
Kellogg Co., E. H.

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Wyckoff Pipe & Creosoting Co.

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Benedict & Burnham Mfg. Co.

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Leslie & Co., Ltd., A. C.
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Stromberg-Carlson Tel. Mfg. Co.
Stuart-Howland Co.
Western Electric Co.

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Phosphor-Bronze Smelting Co.
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Hoffman, George W.

METER TESTERS.
Blakeslee, H. J.

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Jaroslaw, D.
Mica Insulated Co.
Munsell & Co., Eugene.

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Allis-Chalmers Co.
Crocker-Wheeler Co.
General Electric Co.

MODEL MAKERS.
Esterline Co.

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Cincinnati Tool Co.

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Jenkins Bros.
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Phosphor-Bronze Smelting Co.

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Johns-Manville Co., H. W.

PLATINUM.
American Platinum Works.
Baker & Co., Inc.
Roessler & Hasslacher Chemical Co.

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Carlisle & Finch Co.

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Cleveland Twist Drill Co.

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Benjamin Electric Mfg. Co.
Federal Electric Co. (Chicago).
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Federal Electric Co. (Chicago).

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General Electric Co.

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Phœnix Glass Co.

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Liberty Mfg. Co.

REPAIRING.
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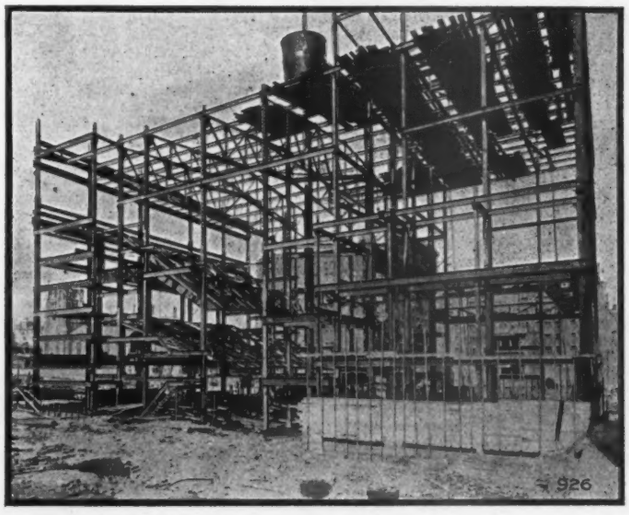

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1	36	Elec. Mach. Co., 3-phase, rev. field	1200
2	45	Westinghouse, single phase	900
1	48	El. Mach. Co.,3-phase, rev. field	1200
1	50	Crocker-Wheeler, 2-phase, rev. field	1200
2	60	Westinghouse, single phase	900
1	60	National, 3-phase, revolving field, 6600 v	1200
1	60	El. Mach. Co., 3-phase, rev. field.	900
1	65	Stanley, 2-phase, inductor type.	900
1	72	El. Mach. Co., 3-phase, rev. field.	720
1	75	Stanley, 2-phase, inductor type.	900
1	75	Westinghouse, 2-phase, distributed winding	720
1	75	Ft. Wayne, Wood, type W. A. L. single phase	600
1	90	El. Mach. Co., 3-phase, rev. field.	720
1	100	Gen. Elec., 3-phase, type A. T.	900
1	100	National, 3-phase, rev. field, 6600 v	900
1	120	Gen. Elec., type A.S., single ph.	900
3	150	Westinghouse, single phase	600
3	150	Ft. Wayne, Wood, type W.A.L., single phase	450
2	150	Gen. Elec., type A.T.B., 3-phase, rev. field, separately excited	600
1	175	Stanley, 2-phase, inductor type.	514
2	200	Gen. Elec., type A.T.B., 3-phase, rev. field, 2300 v., with direct-connect'd compensator exciter	600
1	250	Westinghouse, 2-phase, 3-bearing	450
1	250	Westinghouse, 3-phase, rev. armature, 3-bearing	450
1	300	Gen. Elec., type A.S.B., revolving field, 3-bearing, single ph.	450

25 Cycle Alternators

	KVA.		Speed
1	130	Westinghouse, 3-phase, 440 v., revolving field type	500
1	275	Westinghouse, 3-phase, revolving field, 6600 v	375
1	400	Westinghouse, 3-phase, 440 v., rev. armature type, 3-bearing.	300
1	400	Westinghouse, 3-phase, 440 v., rev. field type, 3-bearing	300

125-133 Cycle Alternators

	KVA.		Speed
1	30	National, toothed arm	1500
2	30	Gen. Elec., type A30	1500
1	30	Gen. Elec., type AS30	1500
2	60	Westinghouse	1650
2	60	Gen. Elec., type AS60	1500
1	75	Ft. Wayne, Wood, type W.A.	1050
1	90	Ft. Wayne, Wood, type W.A.	1050
2	90	Gen. Elec., type A.S.	1250
1	120	Gen. Elec., type A.S.	1070
1	200	Westinghouse, single phase	571

250 Volt D. C. Generators

	KW.		Speed
1	2	Northern, MP, comp.	1750
1	8	Fairbanks-Morse, MP, comp., direct-connected to Racine eng.	375
1	12½	Ideal, MP, comp.	1100
1	12½	Gen. Elec., MP, comp.	1275
1	12½	Gen. Elec., MP, comp.	725
1	17½	Crocker-Wheeler, MP, comp.	1250
1	20	Siemens & Halske, comp.	1100
1	20	Commercial, MP, comp.	1100
1	20	Eddy, MP, comp.	800
1	20	Commercial, MP, comp.	750
1	20	Gen. Elec., MP, comp.	750
1	20	C. & C. Multipolar, comp., direct-con. to Chandler-Taylor engine	320
1	30	Western Elec., MP, comp.	1200
1	30	Ideal, MP, comp., new	600
1	30	Bullock, MP, comp.	1300
1	35	C. & C., comp.	750
1	35	Sprague, 6-pole, comp.	950
2	35	West. Elec., MP, comp.	500
1	37½	Triumph, MP, comp.	850
1	40	Card, MP, comp.	800
2	60	Western Elec , MP, comp.	1050
2	60	Ft. Wayne, 6-pole, comp., direct con. to Harrisburg engines	300
1	100	Gen. Elec., 3-wire unit, Lake Erie engine, direct-con. to two 50 KW Gen. Elec. comp., 125-volt generators	275
1	100	Jenney, 6 pole, comp., direct-con. to Allfree engine	250
1	150	Eddy, MP, G, comp.	475

500 Volt D. C. Generators

	KW.		Speed
1	7½	Westinghouse, MP, type M., comp.	1350
1	12½	Northern, MP, comp.	1050
1	100	Gen. Elec., 6-pole, comp., form H	600
1	150	Northern, MP, comp., 6-pole	625
2	200	Westinghouse, 6-pole, comp.	510
1	250	Westinghouse, 6-pole, comp., 3-bearing	450

220 Volt D. C. Motors

	HP.		Speed
1	1	Westinghouse, type R.	1800
6	1½	Northern series crane motors	1000
1	1½	Crocker-Wheeler	1200
5	2	Northern series crane motors	950
1	2	Northern, MP, series	1000
1	2	Gen. Electric, type C. A.	1800
23	2	Watson, MP, new	1200
1	2	Storey, enclosed Buffing motor.	2700
2	2½	Northern, MP.	1500
3	3	National, MP, new.	1500
1	3	Watson, MP.	1050
1	3½	Peerless, MP, comp.	470
1	5	Northern, MP.	1720
6	5	National, MP, new.	1150
75	5	National, MP, new.	950
3	5	General Elec., MP, type C. E.	675
11	7½	National, MP, new.	1500
1	7½	Triumph, MP.	1300
1	7½	Sprague-Lundell, new.	1525
36	7½	National, MP, shunt, new.	900
1	7½	Gen. Elec., MP, type C. Q.	825
13	10	National, MP, new.	1500
1	10	Storey, enclosed series, crane motor	600
2	10	Gen. Elec., MP, type C. E.	1375
70	10	National, MP, shunt, new.	800
1	15	Westinghouse, MP, type S.	1650
1	15	Allis-Chalmers, MP,	1600
9	15	National, MP, new.	1250
1	15	Northern, MP.	1200
1	15	Allis-Chalmers, MP.	900
1	15	Gen. Elec., MP, type C. Q.	1170
21	15	National, MP, new.	725
1	20	Phoenix, MP.	1050
1	20	Willey, MP.	1150
1	20	Crocker-Wheeler, M.P.	1125
20	20	National, MP, new.	625
1	25	Commercial, MP.	1000
1	25	Allis-Chalmers, MP.	775
6	30	Walker, series, railway type.	450–90
2	30	Western Elec., MP, type EB5.	1000
1	30	National, MP.	950
6	30	National, MP, new.	575
1	35	Western Elec., MP, type E.	1050
1	35	Bullock, MP.	1150
1	35	Ideal, MP, type D., new.	550
1	40	Sprague, 6-pole, type S. L.	850
1	40	C. & C., type MPL.	650
2	40	Western Elec., MP, type 4P.	450
1	45	Triumph, MP.	775
1	45	National, MP.	825
1	50	Card, MP.	700
2	60	West. Elec., MP, type E6AOB.	850

500 Volt D. C. Motors

	H.P.		Speed
9	1	Gen. Elec., type C. A.	1300
1	2	Lundell.	1000
1	2	Gen. Elec., type C. E., with enclosed back gear	1200–300
1	3	Robbins & Myers. MP.	1350
2	3	Gen. Elec., type C. E.	1800
5	3	Gen. Elec., type C. E.	1200
1	4	Westinghouse, MP, type S, comp	1280
1	7½	Northern, MP.	840
1	7½	Gen. Elec., MP, type C. E.	1000
1	7½	Sprague-Lundell.	700
3	10	Gen. Elec., MP, type C. E.	1500
1	10	Westinghouse, MP, type M.	1250
2	10	National, MP, new.	950
2	10	Gen. Elec., MP, type C. E.	800
1	15	Paragon, MP.	1200
2	15	Gen. Elec., MP, type C. E.	1200
1	25	Colonial, MP.	785
10	30	Walker, series, back-geared, 14 to 67, railway type	485–100
1	30	Milwaukee, MP.	1075
3	30	Gen. Elec., MP, form A.	625
1	50	Westinghouse, MP, type M.	800
1	50	Gen. Elec., MP, form A.	550

BOND ISSUES

When money is needed for extension or acquisition of further property, we can furnish the necessary capital.

We sell electric lighting and railway properties, and developed and undeveloped Western Hydro-Electric enterprises.

McGRATH & NEUHAUSEN CO.
Lewis Building
PORTLAND, OREGON

SPARKING

reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire.
All of this may be avoided if you use

The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting.
Absolutely will not gum the brushes.

It will put that high gloss on the commutator you have so long sought after

Send for Stick **50c. PER STICK** **$5.00 PER DOZ.**

For Sale by All Supply Houses or **K. McLENNAN & CO.** Sole Manufacturers

Room 411—130 Dearborn St., CHICAGO

The Coal & Iron National Bank

143 LIBERTY STREET, NEW YORK

CAPITAL	SURPLUS AND PROFITS
$1,000,000.	$335,000

We Finance Extensions and Improvements

to Electric Light, Power and Street Railway properties which have established earnings. If prevented from improving or extending your plant because no more bonds can be issued or sold, or for any other reason, correspond with us.

Electric Bond and Share Company

(Paid-up Capital and Surplus, $4,900,000)

71 Broadway, New York

Dealers in Proven Electric Light, Power and Street Railway Bonds and Stocks.

POSITIONS WANTED

The rate for "Positions Wanted" advertisements of forty words or less is one dollar an insertion; additional words two cents each; payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical World, 239 West Thirty-ninth Street, New York, or 1570 Old Colony Building, Chicago, as advertisers may desire.

OPERATOR desires position in hydroelectric plant; have been in charge of 500-kw power station containing two A. C. units and have experience in high-tension construction work; best of references; permanent position with reliable company desired; now employed; married. Address No. 7075, care of Electrical World, New York.

CAN you use an active, energetic and intelligent young man, age 24, in any department, preferably general testing or construction. Three years' experience testing electrical apparatus of every description; technical education received at Cooper Union. Address No. 7273, care of Electrical World, New York.

ELECTRICIAN, 12 years' practical experience, general construction and repairs; expert knowledge of flaming-arc lamps, having been engaged in the flame lamp business 4 years; capable of doing the work or directing others. Address No. 7274, care of Electrical World, New York.

WANTED.—By a thoroughly experienced operating engineer, for the past 5 years employed as watch engineer in a large steam turbine central station; 7 years on the road as erecting engineer; thorough mechanic and electrician; age 37 years; competent to take charge of installation, operation and repair of modern turbine plants. Address No. 7276, care of Electrical World, New York.

POSITION in power-house or substation is wanted by young man who has had a technical education; have also had some experience. Address 7275, care of Electrical World, 1570 Old Colony Bldg., Chicago, Ill.

SALES and battery man, traveling with line of electric pleasure cars, objects to the road, would like a good motor truck or kindred proposition that offers a permanent location. Address No. 7213, care of Electrical World, New York.

EXPERIENCED electrical engineer is open for engagement requiring ability and resourcefulness; 16 years' experience in erection, maintenance and operation of aerial and underground transmission, electric power plants and storage battery plants; successful manager of labor. Address No. 7167, care of Electrical World, New York.

(Continued on page 76.)

POSITIONS WANTED

(*Continued from page 75.*)

WOULD like to correspond with operating company desiring man for power division; maintenance, industrial, operating; technical graduate; four years with large electrical manufacturing company—test, inspection, engineering; can get results; Assoc. A. I. E. E.; temperate and reliable; age 28; married. Address No. 7252, care of Electrical World, New York.

POSITION WANTED.—High-grade man, age 40, wants to make change; over 15 years with large electric lighting propositions in various executive capacities; entirely familiar with modern and economical operation; thoroughly experienced in general accounting, costs, rates, new business exploitation, etc., and all details of organization, finance and general management; also experienced in the management of properties in competitive territory; safe and hustling executive, tactful, aggressive, resourceful; will consider connection with banking interests or take management first-class proposition. Address No. 7231, care of Electrical World, New York.

MECHANICAL - ELECTRICAL engineer, technical graduate, 1909, with a year's experience in the shops and testing departments of a large electric manufacturing company, desires to locate in sales department with Eastern concern, either mechanical or electrical. Address No. 7239, care of Electrical World, New York.

POSITION WANTED.—Graduate electrical engineer (1909) A. I. E. E., at present employed as student-apprentice with large electrical manufacturing company, desire change of position; will furnish experience in detail. Address 7238, care of Electrical World, New York.

POSITION WANTED.—I am thoroughly acquainted with central station work and have handled the business as well as practical end of small plants; first-class interior wireman and lineman; will consider anything; want to leave Chicago; 16 years' experience. Address No. 7278, care of Electrical World, New York.

POSITION where energy and ability are needed; at present managing a large power property; technical education with engineering and business experience; can make a quick change. Reply No. 7282, care of Electrical World, New York.

A YOUNG man having three years' experience in electrical laboratory desires position in any branch of the electrical line. Address No. 7283, care of Electrical World, New York.

AM in charge of meter repair shop of large electrical manufacturers, familiar with all standard makes; desire position with central station where experience in the electrical operating details throughout are desirable; A1 references; age 26; married. Address No. 7284, care of Electrical World, 1570 Old Colony Bldg., Chicago, Ill.

ELECTRICAL superintendent, inspector, or any situation suitable desired by a man of 27; good general education, theoretical knowledge; nine years' practical experience in maintenance of power and lighting plants and general construction; one year draughting department General Electric; executive ability, business experience; highest credentials; $90 to start; New York City or vicinity preferred. Address No. 7249, care of Electrical World, New York.

POSITION offering construction experience by young man (27) with technical education and extended office experience, including thorough knowledge of cost-keeping methods; has camera suitable for showing progress, also typewriter; will accept position as assistant to superintendent at moderate salary. Address No. 7260, care of Elecrical World, New York.

WANTED by graduate and practical engineer, position as superintendent or manager of electric light and power property; 15 years' experience, including 6 years on engineering end of street railway work; particularly prepared to handle light and power business; employed, but can arrange to call in person. Address No. 7198, care of Electrical World, New York.

PERMANENT location wanted by graduate engineer with 15 years' experience in construction, operation and management of electric light and power properties; position desired justifying a salary of about $2,500. Address No. 7169, care of Electrical World, New York.

POSITIONS VACANT

The rate for "Positions Vacant" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each; payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical World, 239 West Thirty-ninth Street, New York, or 1570 Old Colony Building, Chicago, as advertisers may desire.

(In replying to a "Want" advertisement original letters of recommendation should NOT be forwarded.)

WANTED.—A competent man to take charge of new business department in modern electric plant in southern city; must be capable and able to obtain business under severely competitive conditions; salary $125 a month. Address No. 7264, care of Electrical World, New York.

WANTED.—A thoroughly experienced man as superintendent for a modern electric light plant in the South; must not be over 35 years of age, active and energetic and able to handle men and material to advantage; salary for the right man $150 a month. Address No. 7265, care of Electrical World, New York.

WANTED.—Power solicitor, energetic hustler, must be good mixer; liberal salary and commission is offered to right parties; location Middle West; unusual opportunities for those desiring permanent work and high remuneration. Address No. 7277, care of Electrical World, New York.

WANTED.—Three experienced meter testers, also one motor trouble man; state age, married or single, detailed information regarding past experience, salary expected and references; splendid opportunity to right men; Allegheny County Light Co., 5918 Broad St., Pittsburgh, Pa.

WANTED.—Line foreman; must be sober and industrious, familiar with up-to-date construction and maintenance; 2200-volt, two-phase system in town of 8000, 25 miles from New York City; salary $85 per month with good chance of advancement. Address No. 7272, care Electrical World, New York.

MECHANICAL or electrical engineer, American graduate, with about three years' experience, wanted in maintenance department of manufacturing plant, N. Y. City. Address No. 7245, care of Electrical World, New York.

IN spare time try to invent; promotion and profit often result from patents; mail invention for opinion, no charge; undersigned is the only attorney who is your fellow-member of both the A. I. E. E. and the A. S. M. E.; to engage an attorney not technical enough to belong to technical societies is a waste of money, because he should be expert to match Patent Office expert examiners. Edward P. Thompson, M. E., specialty business with clients by mail in electrical cases. Novelty search, $5; total cost of simple patent, $65; less if inventor makes the drawing. Each case personally prepared; established 20 years. Victor Building, Washington, D. C., or 34 East 32d St., New York.

METER MEN.—Wanted men interested in meter and instrument work to take up the course on "Electrical Measuring Instruments and Meters," as prepared by the Fort Wayne Correspondence School, Fort Wayne, Ind. Write for catalog giving information on meter testing.

WANTED.—An experienced, competent, industrious and honest man to take charge of an established electrical contracting business in a hustling Middle West city; must take stock in company to insure proper interest. Address No. 7175, care of Electrical World, New York.

COMPANY manufacturing complete line of incandescent lamps wants to secure services of several first-class agents and salesmen. Address No. 3320, care of Electrical World, New York.

WANTED.—An electrical manufacturing company wishes to engage several young or middle-aged men who like to write and train them in the preparation of technical literature; ability to write good, plain English is an essential qualification; electrical experience and technical training are desirable, though not essential; these will be particularly desirable positions; in replying, state age and salary expected, and give an outline of experience and schooling. Address No. 7212, care of Electrical World, New York.

WANTED.—Engineer for plant about 30 miles from Rochester, N. Y.; heating, electrical and refrigerating experience required; salary $1200 per year. Address 7235, care of Electrical World, New York.

A WELL-ESTABLISHED manufacturer of electrical apparatus wants a man of high character, good judgment and experience to take charge of calibrating and testing switchboard and portable instruments for direct and alternating current. Must be willing to work, able to instruct and train new material, maintain discipline, develop best qualities in subordinates and turn out apparatus in quantity and of the highest standard. The position will be permanent and with very good prospects for development for the right man. Address No. 7236, care of Electrical World, New York, giving age, experience and some idea of wages.

WANTED. — One third-class subinspector (electrical) at $3.04 per diem. A competitive examination will be held August 8, 1910, to fill the above position. For further information address "Commandant," Navy Yard, Brooklyn, N. Y.

MANUFACTURER'S agent having an established trade in Louisiana, Arkansas, Texas and Oklahoma wanted to handle a standard switch line in that territory. Address No. 7262, care of Electrical World, New York.

WANTED.—A competent man as superintendent to take charge of inside and outside wiring of an electric light and power company in southern city; must be thoroughly capable and experienced in handling men; only reliable hard-working men need apply; salary $125 a month. Address No. 7269, care of Electrical World, New York.

WANTED.—High-grade experienced man to take charge of the business-getting department of this company; must be competent and furnish reference; state age, experience, salary expected and any other information desirable for a probable employer to have. Merchants Heat & Light Co., Edward L. McKee, President, Indianapolis, Ind.

WANTED.—A young technical graduate to take charge of testing and inspection department of a plant manufacturing high-tension porcelain insulators, located in the middle States; state age, experience, salary expected and give references; young man with one or two years' practical experience preferred. Address No. 7263, care of Electrical World, New York.

WANTED—The services of several experienced salesmen of electric lamps; men who have done illuminating engineering work in connection with sales work preferred; these men wanted for positions as managers of branch offices by a large company manufacturing electric lamps, fixtures, reflectors, etc. Address No. 7281, care of Electrical World, New York.

HELP WANTED—A-1, ambitious experienced business getter, by electric power and light company; salary to start, $00 per month; fine chance for advancement with progressive syndicate operating in Oregon and Washington; services solicitor needed as soon as possible. Address No. 7286, care of Electrical World, New York.

EDUCATIONAL

The rate for "Educational" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each; payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.—Courses in Civil, Mechanical and Electrical Engineering, and General Sciences, leading to the degree of Civil Engineer (C. E.), Mechanical Engineer (M. E.), Electrical Engineer (E. E.) and Bachelor of Sciences (B. S.). Special courses in Engineering and Sciences. Splendidly equipped new engineering laboratories. Send for catalogs to the Registrar.

DETROIT TECHNICAL INSTITUTE, DETROIT, MICH.—Co-operative engineering course, leading to the degree of B. S. in mechanical or electrical engineering; a course offering to students a technical education, practical shop work and at the same time a chance to earn a large portion of their running expenses; schedule is arranged for men who are high school graduates; also for men with eighth grade education; shop work starts July 1. Trades: Day and evening courses in plumbing and watchmaking; send for catalog.

(*Continued on page 77.*)

Frank MacGovern J. Warren Archer

MacGovern, Archer & Co.

114-118 Liberty Street Electrical and Steam Machinery NEW YORK
'PHONE, CORT. 5677

ALTERNATING CURRENT UNITS

1—750 KW. Stanley (2 or 3 phase) 60-cycle, 2400 volts, 90 RPM., direct connected to 24" & 48" x 48" cross compound Penn. Iron Works corliss engine.
1—750 KW. Stanley (2 or 3 phase) 60-cycle, 2400 volts, 90 RPM., for direct connection to engine or water wheel.
1—300 KW. Westinghouse (2 or 3 phase) 60-cycle, 2300 volts, 150 RPM., direct connected to 14" & 28" x 30" heavy duty cross compound 4-valve engine.

MOTOR GENERATOR SET (125 Volt D. C.)

1—300 KW. Westg. 3-ph., 60 cy., 2300 V. synchronous motor or generator (revolving field type) direct coupled on c.i. base to
1—300 KW. Westg. 125 V., comp. wound, MP., d.c. generator or motor. Speed of set 514 RPM.

G. E. TUB TRANSFORMERS

6—68 KW. G. E., 60 cycle transformers, type R, form B, 2300 volts primary, 6.8 amp. secondary. Each with panel.

A. C. GENERATORS—2 ph. 60 cycle

1—450 KW. Stanley, 2400 volts, 3 bearing type.
1— 75 KW. Westinghouse, 720 RPM.

ALTERNATING CURRENT GENERATORS—3 ph. 60 cycle

1—300 KW. G. E., 2300 volts, 450 RPM.
3—200 KW. G. E., 2300 volts, type ATB, 600 RPM.
1—150 KW. G. E., 2300 volts, type ATB, 600 RPM.
1—100 KW. G. E., 240 volts, type ATB, 900 RPM.
1— 75 KW. G. E., 2300 volts, type ATB, 900 RPM.

DIRECT CURRENT GENERATORS—250 volts

1—170 KW. Western Elec., type LG, 6 poles, 550 RPM.
2—100 KW. Westg., 6 poles, 580 RPM.
2—80 KW. C. W., type DC, 4 poles, 650 RPM.

BOILERS

3—72" x 18' Return Tubular, 125 lbs. pressure.
3—260 HP. Heine, 150 lbs. pressure.
3—175 HP. Vertical Manning.
1—84" x 19' Return Tubular.
6—250 HP. Vertical Hazleton, 140 lbs. pressure.

Also large stock A. C. and D. C. Motors and Dynamos of all kinds, Engines, Boilers, etc.

ARTHUR S. PARTRIDGE ST. LOUIS 417 Pine Street

This

800 KW. A. C. UNIT FOR SALE

IMMEDIATE SHIPMENT. BARGAIN PRICE.

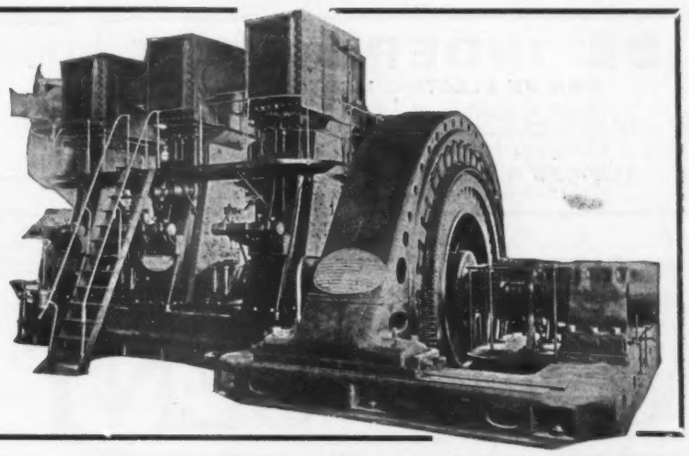
Generator is 800 kw., 2300 volts, 2 or 3 phases, 60 cycles. Engine is Cross Compound (double expansion, not triple), has two low pressure cylinders. Perfect condition, very economical, needs no repairs.

Also offer at decidedly low prices the following A. C. units:

300 K.W. G.E. 2300 V. 2 P. 60 cycles 120 R.P.M. with Cross C. Corliss Eng.
350 K.W. G.E. 2300 V. 3 P. 60 cycles 150 R.P.M. with Tandem C. 4-val. Eng.
3--500 K.W. Westg. 2300 V. 3 P. 60 cycles 90 R.P.M. with Cross C. Corliss Eng.
3--500 K.W. Stanley 2300 V. 2 P. 60 cycles 100 R.P.M. with Cross C. Corliss Eng.
1715 K.W. Stanley 2300 V. 3 P. 60 cycles 100 R.P.M. with Cross C. Corliss Eng.
3000 K.W. G.E. 13200 V. 3 P. 25 cycles 75 R.P.M. with Cross C. Corliss Eng.

7 Heine Boilers, 1-350 H.P—6-220 H.P. high pressure

Let Us Know Your Wants. We Can Furnish Complete Plants



WANTED

Two 500-KW, two-phase, 60-cycle, 2300-volt, direct connected Generators.

Westinghouse, General Electric, Bullock or Allis-Chalmers preferred.

Address No. 7271, Care of Electrical World, New York

Rose Polytechnic Institute

Terre Haute, Indiana

A College of Engineering; courses in Mechanical, Electrical, Civil and Chemical Engineering and Architecture. Extensive shops, well-equipped laboratories in all departments, expenses low. 27th year. For catalogue containing full information and professional register of alumni, address

C. L. MEES, President

MISCELLANEOUS

(*Continued from page 76.*)

WANTED.—Meter testers to send for our new meter-testing book, giving full information on connecting and testing meters. This book, sent free upon request, will enable you to increase the efficiency of the meter department. Central Electric Co., Chicago.

MANUFACTURER wishes to correspond with well-connected Chicago selling agency who could handle the best low-tension magneto ever put upon the market; also small generators and motors; all three types of machines can be sold at the right price. Address No. 7279, care of Electrical World, New York.

ELECTRIC light power system and power transmission lines financed and built; electric light properties bought and sold; improvements for light plants or water works, under private or municipal ownership, financed and built. Robert S. Ashe, Richmond, Ind.

SOLE AGENCIES WANTED FOR NORWAY.—Electrical engineer with years of experience in America and Europe, associate member American Institute of Electrical Engineers, member Norwegian Society of Engineers, will soon open engineering office and supply business in the central part of Norway, desires electric railway supplies, lamps, wires, apparatus and specialties of everything electrical, as well as mining machinery. Address No. 7268, care of Electrical World, Chicago, Ill.

PROPOSALS

TREASURY Department, Office of Supervising Architect, Washington, D. C., June 24, 1910.—Sealed proposals will be received at this office until 3 o'clock p. m., Wednesday, July 20, 1910, and then opened, for furnishing and installing lighting fixtures in the U. S. buildings at Boulder, Colo.; Clarinda, Iowa; Fayetteville, Ark.; Kearney, Neb.; Logan, Utah; Marion, Ohio; Mayfield, Ky.; Pittsburg, Kan.; Shenandoah, Iowa; Newark, New Jersey., in accordance with the drawings and specifications, copies of which may be obtained at this office at the discretion of the Supervising Architect. The right is reserved to reject any and all bids, and to waive defects. Each proposal must be accompanied by a certified check in the sum of 10 per cent of the aggregate amount thereof, drawn to the order of the Treasurer of the United States, as a guarantee of good faith. Proposals should be addressed to the Supervising Architect, Treasury Department, Washington, D. C., and the envelope marked "Proposals for Lighting Fixtures, U. S. Buildings at Boulder, Colo.; Clarinda, Iowa; Fayetteville, Ark.; Kearney, Neb.; Logan, Utah; Marion, Ohio; Mayfield, Ky.; Pittsburg, Kans.; Shenandoah, Iowa, and Newark, N. J." James Knox Taylor, Supervising Architect.

HERRINGTON, KANS.—Bids will be received by G. W. Krause, City Clerk, until July 15, at 7 p. m., for constructing a sewer system. City to reserve the right to reject any or all bids. Plans and specifications can be had of Burns & McDonnell, engineers, Scarrett Bldg., Kansas City, Mo. G. W. Krause, City Clerk.

COMMONWEALTH EDISON CO.
REPAIR SHOPS
76 MARKET ST., CHICAGO. TELEPHONE RANDOLPH 1280.
FIRST-CLASS EQUIPMENT THROUGHOUT
DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, HIGH GRADE MACHINE WORK OF ALL KINDS
CORRESPONDENCE SOLICITED

CAPITAL FURNISHED
for established enterprises desiring to enlarge and extend their operations. May be had for long period on advantageous terms.
Funding Company of America, 40 Exchange Place, N. Y.

For Sale Three 50 K. W. American transformers. 2000 volts primary, 1000 volts secondary. These transformers are in first-class condition, having been in use about six months.
CONSOLIDATED GAS COMPANY OF NEW JERSEY
LONG BRANCH, NEW JERSEY

FOR SALE

267 H. P. (2) B. & W. Watertube boilers; certificate 160 lbs.	$2,250
228 H. P. ditto; certificate 160 lbs.	1,000
65 K. W. General Electric, M. P. generator	450
14x30 "Frick" Corliss engine	675
12x36 "Wheelock" Corliss engine (overhauled)	550
20 H. P. C. & C. 220 volt motor; 1100 RPM	135

DUZETS & SON, 50 Church Street, NEW YORK

FOR SALE
Two New 50-K.W., 25 to 60 Cycle Transformers
10,000 to 20,000-Volt Primary 110-220-440-Volt Secondary
Original Value $1,500 Our Bargain Price **$1,000 for the two**
Ready for immediate delivery, fully guaranteed and subject to inspection at Toledo, Ohio.
Above price includes both Transformers and necessary oil.
THE F. BISSELL COMPANY, Toledo, Ohio

BE INDEPENDENT
OWN AN ELECTRIC LIGHTING PLANT
We have a number of attractive opportunities to offer in different sections of the country. If you have $3,000 or more, write us.
THE GAS & ELECTRIC DEVELOPMENT CO.
1328 Chestnut Street, Philadelphia, Pa.

IN 601 FOREIGN CITIES
There live subscribers to the
ELECTRICAL WORLD

ONE CENT A DAY

¶ This is all it costs you to keep abreast of progress in the electrical field—to get all the news of the electrical art and industries while it is still fresh and valuable.

¶ The price of the ***Electrical World*** to subscribers amounts to less than one cent a day, and it is a most potent factor in the success of thousands of men engaged in electrical work.

Why not send that $3.00 to-day?

ELECTRICAL WORLD

239 West 39th Street **NEW YORK, N. Y.**

Promoting New Business

can be efficiently done only under a *systematic* plan.

Our Co-operative Selling Plan

is a systematic, almost automatic, method of developing new business and lots of it, for the Central Station and Dealer.

We do the work—you and we mutually get the business.

The co-operation is mostly on our part, but a little is required of the Central Station or Dealer.

To avail yourself of the plan we present, means better profits and a bigger volume of business for you.

It will produce new and profitable customers for you with scarcely any effort on your part.

All you have to do is to take care of the business when you get it.

For the Central Station

this plan presents enormous possibilities for developing the use of current, and of providing in addition an *immediate* source of profit to the Central Station.

For the Dealer

this plan provides an immediately profitable department, costing only a little time to handle, requires an investment so small that it is not worth discussion and insures a rapid increase of sales.

You will find it well worth your while to know all about this plan for increasing *your* business as well as ours.

So ask us for our proposition. Use the coupon for convenience.

The Bissell Motor Company
Toledo, Ohio

Tear Off, Sign and Mail

The Bissell Motor Co.
Toledo, Ohio

Please send details of your Co-operative Selling Plan.

Name.....

Street No.....

Town.....

State.....

It's A Simple Matter

for any jobber or contractor to carry phones for practically any battery system if he stocks with the

Connecticut

Metal Type

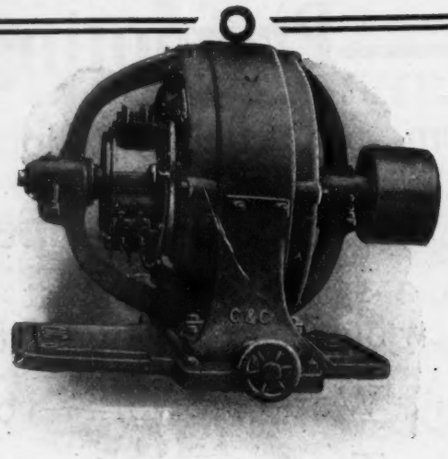
Interchangeable Telephone

By simply placing jumper wires inside as shown in diagrams which we furnish it can be arranged for any battery system, or for use in connection with other makes of battery phones.

Bulletin No. 65-W goes into detail. Get it.

Connecticut Telephone & Elec. Co.
32 Britannia Street
MERIDEN, CONN.

15 Years' Experience



C & C

Dynamos and Motors

40,000 IN OPERATION

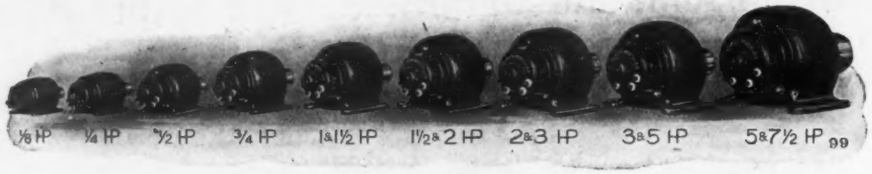
Garwood Electric Company

Sole Manufacturers of C & C Apparatus

Main Office and Works, GARWOOD, N. J.

New York: 149 Broadway.
Boston: 176 Federal St.
Seattle, Wash.: Montilius Price Co.
Philadelphia: West End Trust Bldg.
Pittsburg: Ludwig Hommel & Co., Lewis Block.
Chicago: Old Colony Bldg.
St. Louis: Bank of Commerce Bldg.
Charlotte, N. C.: Charlotte Contract Co.
Canada: Fellowes & Fellowes,
Toronto General Trust Bldg., Toronto.

There Are Two Profits for the Dealer



Row of **C-W** Form L Motors ¼ to 7½ H. P.

in **C-W** Form L motors. An immediate profit in cash and a later profit in the shape of increased business and satisfied customers. This statement is important to you, and is worth looking into. Let us tell you more.

Crocker-Wheeler Company Ampere, N. J.

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Decision on Injury from Contact with a Telephone Wire Crossed with Electric Light Wire 1658
House Mover Liable for Injuries to Underground Electric Cable 1658
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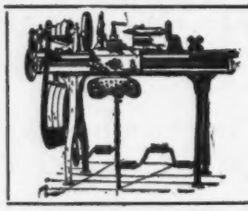

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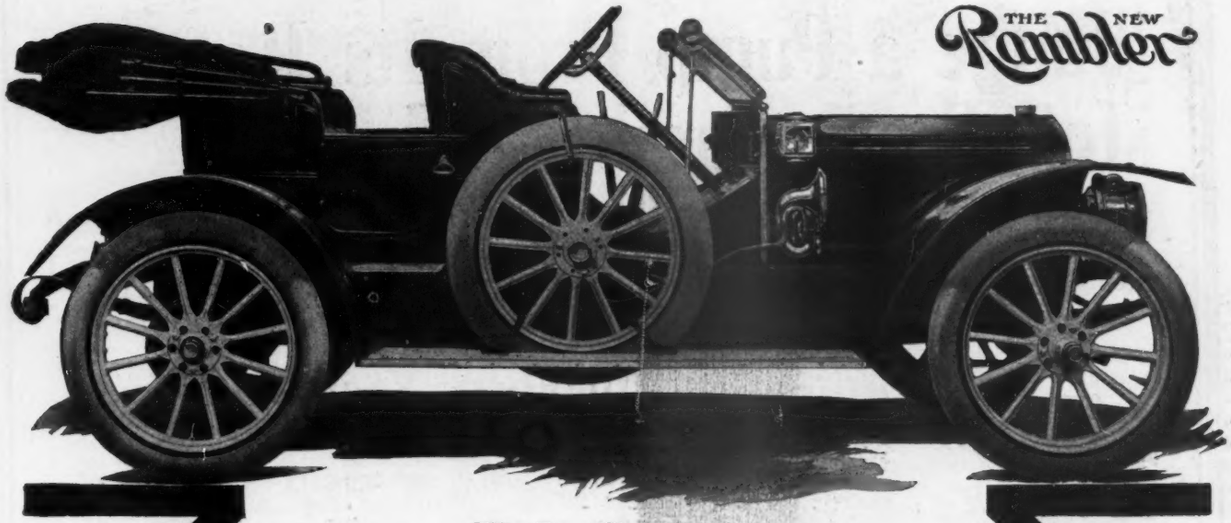

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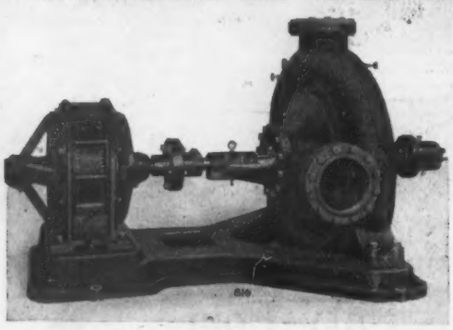

Fig. No. 218—No. 10 Single Stage Turbine Pump, on Bed Plate, with Direct Connected Motor

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Fig. No. 70—Smith-Vaile Duplex Power Pump

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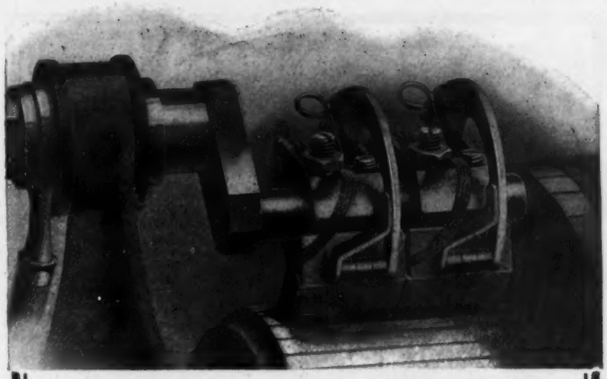

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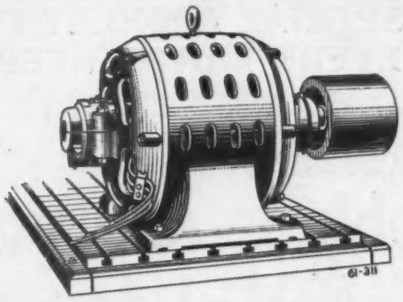

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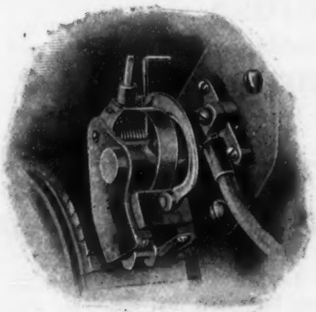

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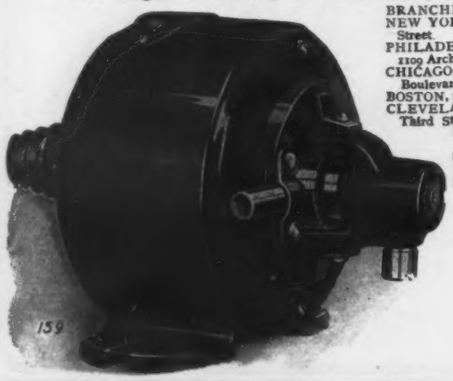

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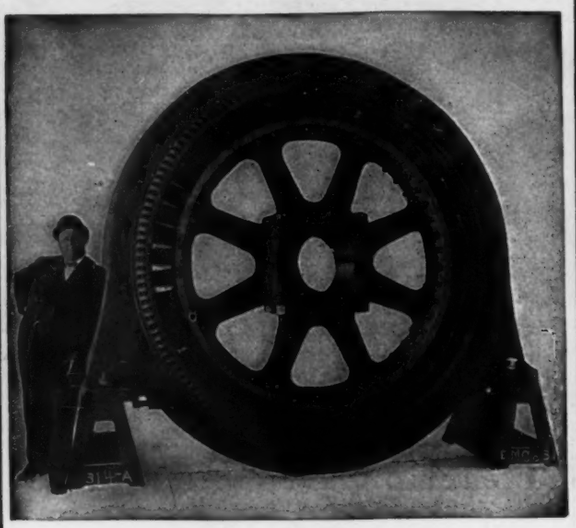

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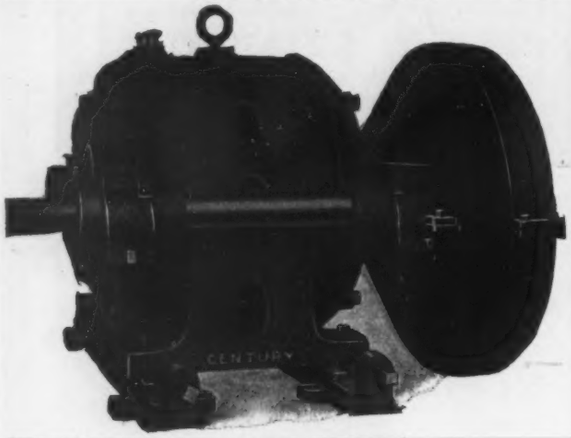

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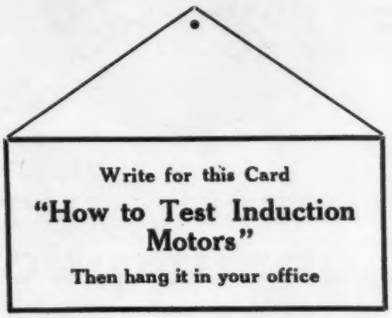

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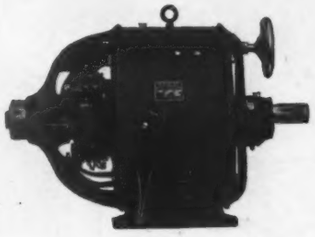

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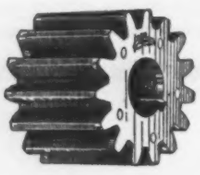

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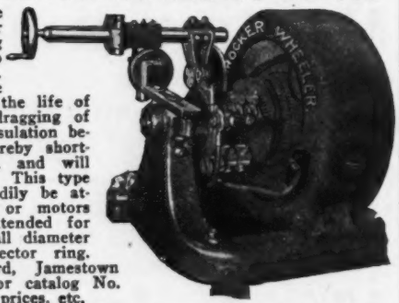

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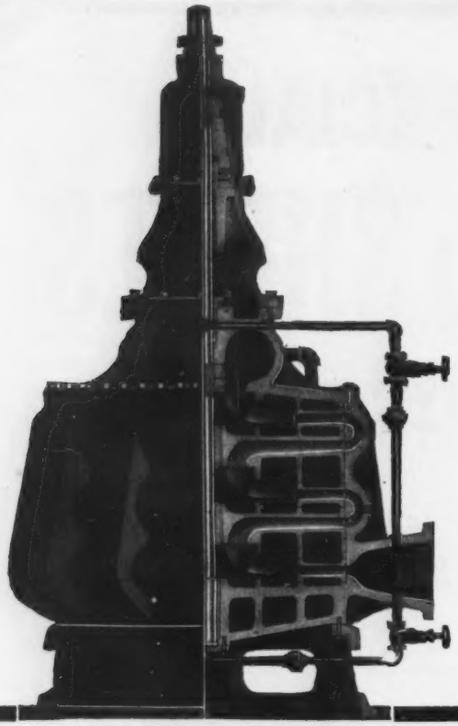

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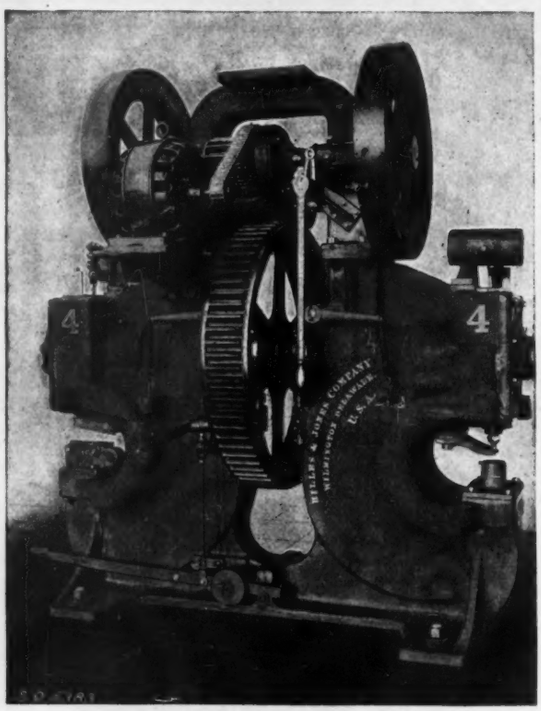

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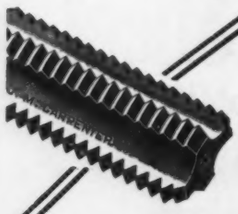

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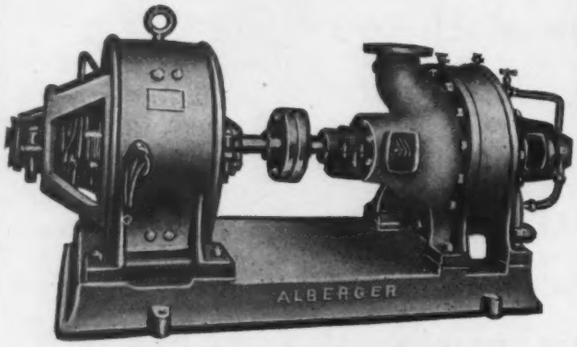

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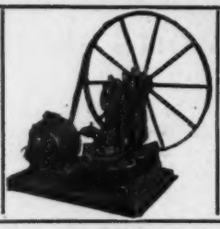

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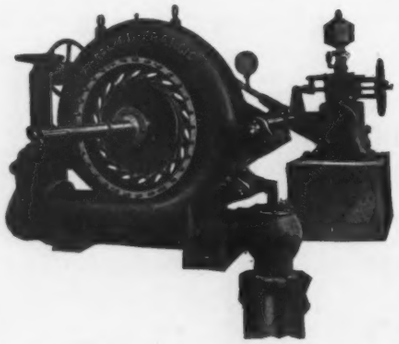

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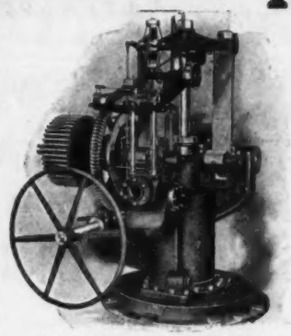

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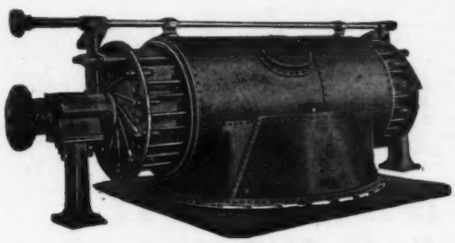

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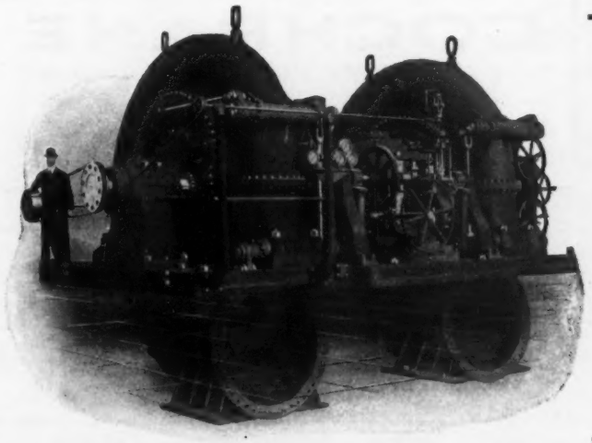

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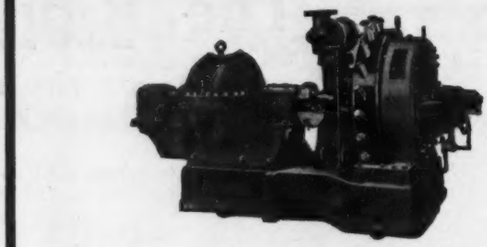

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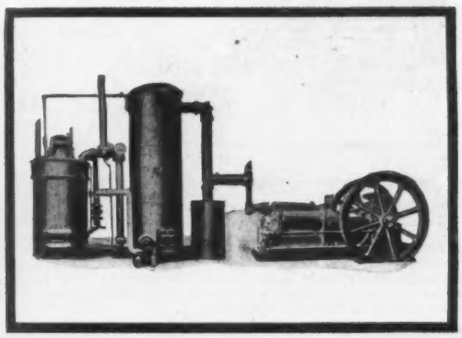

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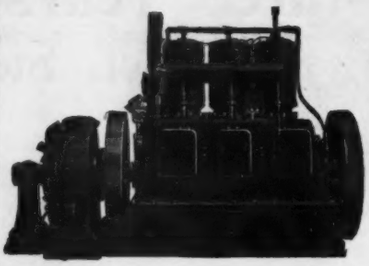

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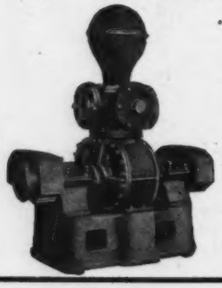

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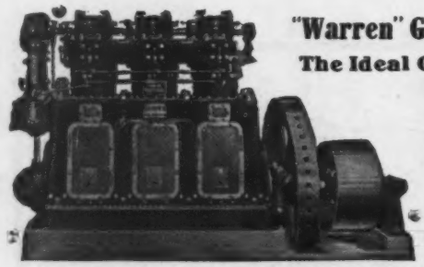

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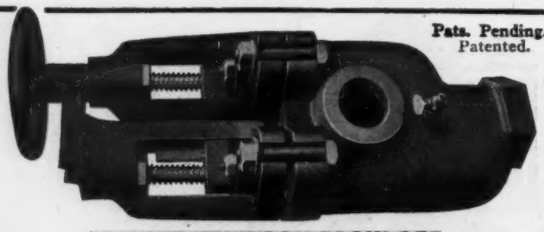

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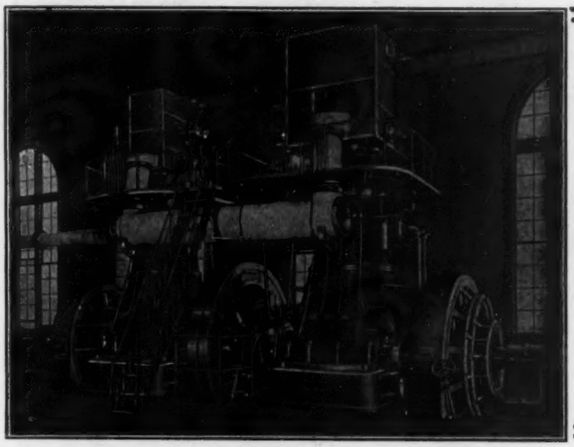

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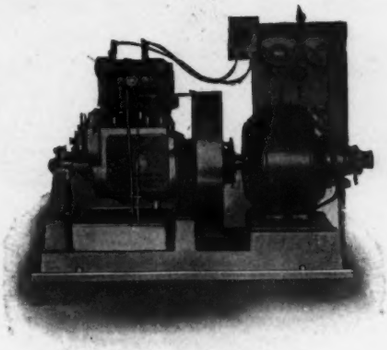

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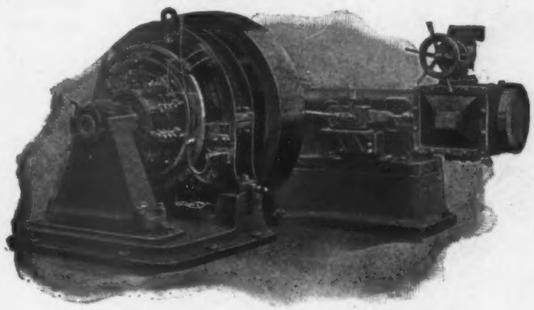

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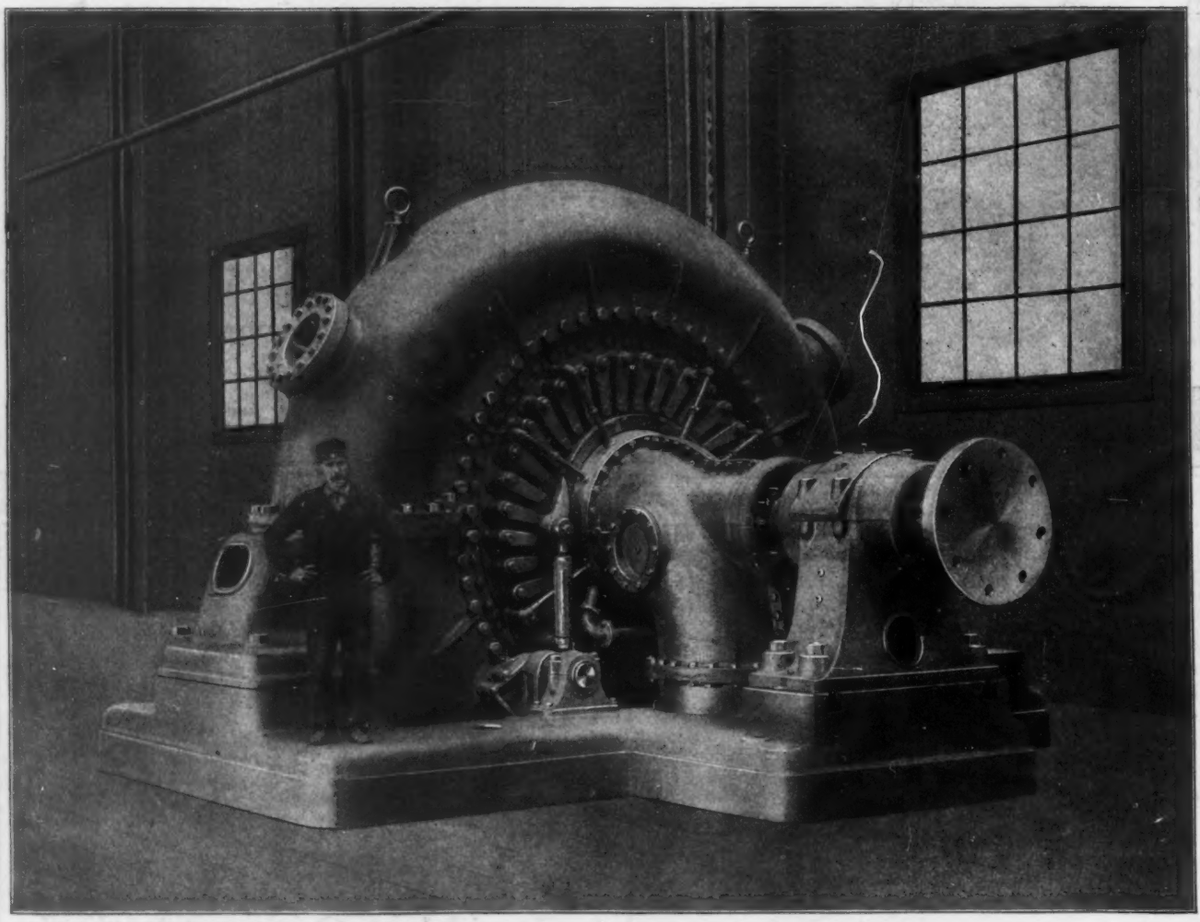

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As we have never used Matthews' Guy Anchors you may ship us the number of anchors marked below and one 567 wrench for their installation with the understanding that if we find after 30 days that they do not save us money we may return them freight charges collect and receive cancellation of your bill. We understand that you will prepay the freight if our order calls for 12 or more anchors and a wrench.

...No. 502R...No. 603R...No. 704R...No. 567 wrench
...No. 800.....No. 1000....No. 1200
(Fill in number of each size wanted)

If you will send us an order as suggested above on your letterhead or regular order form, the anchors will be shipped by return freight.

A SAVING OF AT LEAST 20% GUARANTEED BEFORE YOU PAY US A CENT

That is the way we have sold thousands of Matthews' Guy Anchors in the past ten years and that is the way we want to sell everyone who has poles, fences, smoke stacks, sheds, or anything needing a safe and economical ground anchorage. Send us your trial order made out in accordance with the terms set forth in advt. on left hand side of this page. Then you decide whether you want to keep them or not.

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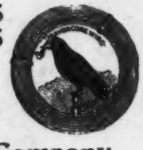

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